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MATHEMATICS ANXIETY THROUGH THE LENS OF GENDER AND TEACHER PROFESSIONAL PHASE IN NIGERIA

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Abstract

Mathematics anxiety has been a persistent challenge for decades, influencing not only learners' academic performance but also the teaching efficacy of educators. This study examined the influence of gender (male vs. female) and professional phase (pre-service vs. in-service) on mathematics anxiety among teachers in Lagos State, Nigeria. A descriptive survey design was employed, involving 167 participants (127 pre-service teachers and 40 in-service teachers) selected using random sampling techniques. Data were collected using the 24-item Mathematics Anxiety Rating Scale (MARS), which demonstrated strong internal consistency (Cronbach's $\alpha = 0.94$). Findings revealed that 65.6% of all respondents exhibited low levels of mathematics anxiety, while approximately one-third reported high anxiety. Independent t-tests indicated no significant differences in mathematics anxiety levels across professional phases ($p = 0.226$) or gender ($p = 0.308$). These results suggest that mathematics anxiety is a pervasive issue, transcending gender boundaries and years of teaching experience. The study draws on Bandura's Social Cognitive Theory, Cognitive Interference Theory, and Cognitive Load Theory to interpret findings, emphasizing the role of self-efficacy, intrusive thoughts, and mental workload in anxiety development. Implications include integrating anxiety-reduction strategies, fostering mathematics self-efficacy, and creating supportive teacher development programs. This study provides insights for policymakers, teacher educators, and curriculum designers to mitigate math anxiety and enhance teacher effectiveness.

Keywords: Mathematics anxiety, Pre-service teachers, In-service teachers, Gender, Teacher education, Self-efficacy.

Introduction

Mathematics is often described as the universal language of science and technology and is widely regarded as the cornerstone of STEM (Science, Technology, Engineering, and Mathematics) education. It plays a vital role in the intellectual development of individuals and the socio-economic advancement of societies. As a discipline, mathematics develops problem-solving skills, logical reasoning, abstract thinking, and critical decision-making abilities, which are essential for coping with the challenges of the 21st century (Beilock & Maloney, 2015; Awofala & Lawal, 2022; Ajao & Awofala, 2024). In today's globalized world, where economies depend on technological innovation and scientific discovery, proficiency in mathematics (Awofala, 2017) is no longer optional but a fundamental requirement for sustainable development. Nations that excel in mathematics education often lead in technological innovation, research, and industrial competitiveness. However, despite the recognized importance of mathematics, it remains one of the most feared and

misunderstood subjects among learners and, disturbingly, even among teachers. Many individuals experience a persistent form of emotional distress when confronted with mathematics-related tasks, commonly referred to as mathematics anxiety. This phenomenon is not limited to school-age children; it is also prevalent among adults, including those in the teaching profession (Foley et al., 2017; Awofala et al., 2024).

The pervasive nature of mathematics anxiety raises concerns about the quality of mathematics instruction in schools and the preparedness of teachers to foster positive mathematical experiences for their students. Mathematics anxiety (MA) has been widely studied over the past five decades, with research consistently showing its negative impact on learning outcomes, career choices, and teacher effectiveness. Richardson and Suinn (1972), pioneers in the field, defined mathematics anxiety as feelings of tension and apprehension that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations. This definition highlights the affective, cognitive, and behavioral dimensions of mathematics anxiety. It manifests through fear, avoidance behaviors, self-doubt, and even physical symptoms such as sweating or rapid heartbeat when confronted with mathematical tasks.

Mathematics anxiety is especially concerning in today's world because of its intergenerational effects. Research by Maloney et al. (2015) demonstrated that teachers and parents with high levels of math anxiety may inadvertently transmit their fears to children, leading to lower achievement and increased avoidance behaviors among students. Thus, mathematics anxiety is not merely a personal issue; it is a societal challenge with implications for workforce development, national competitiveness, and social mobility. For countries like Nigeria, where mathematics is compulsory at the basic and secondary education levels (Awofala & Lawal, 2022; Okunuga, Awofala & Osarenren, 2020), the presence of anxious mathematics teachers could seriously undermine educational reforms and national development goals.

Problem Statement

Despite decades of research, mathematics anxiety remains a persistent barrier to effective mathematics teaching and learning. While many studies have explored student anxiety, relatively few have focused on teachers, especially in the African context. Even fewer have compared anxiety levels across professional phases or examined the role of gender in shaping these experiences. In Nigeria, where mathematics is compulsory in schools and central to national development goals, the presence of anxious teachers poses a serious risk to educational quality. If pre-service teachers graduate with unresolved anxieties, they may enter the workforce ill-equipped to inspire confidence and competence in their students.

Similarly, in-service teachers with high anxiety may unintentionally perpetuate negative attitudes toward mathematics among learners. Thus, there is an urgent need to investigate how professional phase and gender influence mathematics anxiety among Nigerian teachers. Such insights can inform teacher education programs, professional development initiatives, and policy reforms aimed at breaking the cycle of anxiety and underachievement.

The primary purpose of this study is to examine the role of gender (male vs. female) and professional phase (pre-service vs. in-service) in shaping mathematics anxiety among teachers in Lagos State, Nigeria. Specifically, the study seeks to: 1. Determine the general levels of mathematics anxiety among pre-service and in-service teachers. 2. Compare anxiety levels between pre-service and in-service teachers. 3. Explore gender differences in mathematics anxiety within and across professional phases.

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Significance of the Study

This study is significant for several reasons: The findings could provide evidence to guide the design of curricula and interventions aimed at reducing mathematics anxiety among pre-service teachers. Insights into anxiety patterns can inform professional development programs and support services for practicing teachers. The study highlights the need for systemic reforms to address the emotional and cognitive dimensions of teaching, alongside pedagogical skills. By comparing professional phases and genders, the study lays the groundwork for more nuanced investigations into the causes and consequences of mathematics anxiety.

Research Question

The study is guided by the following research questions:

1) What is the general level of mathematics anxiety among pre-service and in-service teachers?
2) Is there a statistically significant difference in mathematics anxiety between pre-service and in-service teachers?
3) Does gender affect mathematics anxiety among pre-service and in-service teachers?

Hypotheses

The study tested the following hypotheses:

Hypothesis 1. There is no statistically significant difference in mathematics anxiety between pre-service and in-service teachers

Hypothesis 2. There is no statistically significant gender difference in mathematics anxiety among all teachers.

Hypothesis 3. There is no statistically significant gender difference in mathematics anxiety among pre-service teachers.

Hypothesis 4. There is no statistically significant gender difference in mathematics anxiety among in-service teachers.

Literature Review

The Nature of Mathematics Anxiety

Mathematics anxiety is a multidimensional construct that involves emotional, cognitive, and physiological components. At the emotional level, it produces fear, frustration, and feelings of helplessness. Cognitively, it interferes with the efficient processing of mathematical information by overloading the working memory with intrusive thoughts such as self-doubt or fear of failure (Sarason, 1984). Physiologically, individuals may experience symptoms such as sweating, trembling, or increased heart rate during mathematical tasks, similar to other forms of performance anxiety.

Several factors contribute to the development of mathematics anxiety: Students with weak mathematical foundations are more likely to experience frustration and anxiety when exposed to higher-level concepts (Estonanto & Dio, 2019). Harsh teaching methods, punitive assessments, and early failure experiences often create lasting negative associations with mathematics. Teachers with high math anxiety may unconsciously convey their fears to students through non-verbal cues or limited instructional strategies (Beilock et al., 2010). Cultural beliefs, such as the idea that mathematics is a "male domain," can reduce confidence among underrepresented groups, particularly women (Luttenberger et al., 2018). Complex or abstract mathematical concepts can overwhelm cognitive resources, especially when presented without adequate scaffolding (Sweller, 1988). These factors highlight that mathematics anxiety is not merely an individual weakness but rather the result of systemic and social influences that operate at multiple levels.

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Gender and Mathematics Anxiety

Gender has long been recognized as a significant factor in mathematics anxiety. Numerous studies have reported that females tend to exhibit higher levels of math anxiety than males (Hart & Ganley, 2019; Luttenberger et al., 2018). This gender gap is often attributed to societal stereotypes portraying mathematics as a masculine domain. Girls and women who internalize these messages may develop lower self-confidence and higher anxiety, even when their actual performance is equal to or better than that of their male peers. In the Nigerian context, gender disparities are evident in mathematics education. Salman et al. (2011) reported consistently lower enrollment of female students in mathematics-related courses at tertiary institutions. Such disparities not only reflect social barriers but also reinforce the perception that mathematics is unsuitable for women, creating a self-fulfilling prophecy. However, recent research suggests that gender differences in mathematics anxiety may be context-dependent. Patkin and Greenstein (2020) found minimal gender differences in certain cultural settings where male and female teachers had similar training and responsibilities. This raises important questions about the role of environmental factors, such as curriculum design and teacher support systems, in shaping gendered experiences of mathematics anxiety.

Why teacher Mathematics Anxiety (MA) matters: Transmission and classroom effects

A key reason teacher MA has become a research priority is its documented downstream effects on students. Seminal experimental and large-scale observational studies show that teacher math anxiety can influence students' achievement and beliefs about who can succeed in math. Beilock and colleagues demonstrated that elementary teachers' MA was associated with lowered math achievement among their female students, a finding that suggests teachers' affective signals can shape gendered beliefs in the classroom. More recently, Ramirez et al. (2018) used large datasets to show that higher teacher MA relates to reduced student math achievement and that this association is mediated by students' perceptions of teachers' beliefs about math ability (e.g., fixed vs. growth mindsets). In other words, anxious teachers may convey limiting beliefs (intentionally or not) that students internalize, which then influences motivation, engagement, and performance (Awofala et al., 2024). These lines of evidence make the case that teacher MA is not solely an individual welfare problem it is a structural issue with implications for educational equity and systemic math outcomes.

Professional phase: pre-service vs in-service teachers and Mathematics Anxiety

The concept of professional phase distinguishes between teachers who are still in training (pre-service) and those actively working in schools (in-service). Investigating how mathematics anxiety varies across these phases is critical for several reasons. Pre-service teachers represent the future of the teaching profession. If they enter the workforce with unresolved mathematics anxiety, it is likely to influence their instructional practices throughout their careers. Boyd et al. (2014) emphasize that teacher education programs must address pre-service teachers' emotional and cognitive barriers to mathematics as part of comprehensive professional preparation. In-service teachers, by contrast, are already shaping young minds. Their attitudes toward mathematics directly affect their students' experiences. Studies such as Patkin and Greenstein (2020) reveal that in-service teachers with specialized mathematics training tend to report lower anxiety than those without such training, highlighting the importance of professional development. Comparing anxiety levels across these two groups can provide insights into: whether teaching experience reduces anxiety over time; the effectiveness of current teacher education programs in preparing confident mathematics educators; and the potential gaps in ongoing professional development efforts. Comparisons of pre-service and in-service teachers have yielded complex findings. Pre-service teachers often enter training with preexisting MA that stems from earlier negative experiences and shaky mathematical foundations

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(Olson & Stoehr, 2019). If teacher education does not explicitly address affective barriers, these anxieties may crystallize into practices that persist into the classroom. Conversely, some studies suggest that teaching experience can attenuate MA for some individuals, especially when the experience includes effective professional development or specialized math content courses (Patkin & Greenstein, 2020). However, other longitudinal and cross-sectional studies report minimal change across the transition from pre-service to in-service for many teachers particularly those who lack targeted support suggesting that experience alone is not a guaranteed remedy (Gresham, 2017). This aligns with the finding of no significant difference between the two professional phases, which underscores the need for explicit, systematic interventions during and after initial teacher preparation (Arigbabu, 2006).

Theoretical Perspectives

This study is guided by three interrelated theories that provide a framework for understanding the complex dynamics of mathematics anxiety: Bandura's Social Cognitive Theory (1986)-: This theory emphasizes the role of self-efficacy, or belief in one's capabilities, in shaping behavior and performance. Teachers with low mathematical self-efficacy are more likely to experience anxiety, avoid challenging tasks, and limit their instructional effectiveness. Social influences, such as stereotypes and peer feedback, further shape these self-beliefs. Cognitive Interference Theory (Sarason, 1984)-: This theory explains how anxiety disrupts performance by occupying working memory with intrusive thoughts like worry and self-doubt. For teachers, this means that anxiety can interfere with lesson planning, problem-solving, and classroom management. Cognitive Load Theory (Sweller, 1988)-: This theory posits that the human cognitive system has a limited capacity for processing information. High levels of anxiety increase cognitive load, reducing the resources available for learning and teaching tasks. Pre-service teachers, in particular, may be vulnerable to cognitive overload as they navigate both learning and teaching simultaneously. By integrating these theories, the study provides a comprehensive understanding of how personal beliefs, emotional states, and cognitive processes interact to influence mathematics anxiety.

Global and Nigerian Context

Mathematics anxiety (MA) is a global phenomenon, but its manifestations vary across cultural and educational contexts. In developed countries, research has focused on understanding the psychological mechanisms of anxiety and developing interventions such as mindfulness training, peer mentoring, and curriculum redesign (Foley et al., 2017). In Nigeria and other developing nations, the issue is compounded by systemic challenges such as: Insufficient teacher preparation programs; Overcrowded classrooms and limited teaching resources; Curriculum overload with insufficient emphasis on practical application; Socioeconomic barriers, including gender inequities and rural-urban divides. Given these challenges, Nigerian teachers face unique stressors that may contribute to higher levels of mathematics anxiety. Understanding these contextual factors is essential for designing targeted interventions. Research literature in Nigeria maps MA across school levels (primary → tertiary), links it to cognitive, affective and technological factors, evaluates measurement instruments, and tests classroom interventions. MA is frequently examined alongside self-efficacy and attitude toward mathematics as both predictors and mediators of achievement. (Awofala & Awolola, 2011). There are studies relate cognitive slips/failures to MA and mathematics performance (Awofala & Odogwu, 2017; Awofala et al., 2025). Nomophobia, smartphone addiction, and computer-based testing are investigated as correlates or causal influences on MA (Awofala & Esealuka, 2021; Adebiyi, Awofala & Malik, 2024; Awofala, 2020). Teacher MA and mathematics teaching anxiety are treated as predictors of student outcomes (Awofala et al., 2024). Depression

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and COVID-19-related fear are examined as predictors of preservice teachers' MA (Awofala & Ogunsanya, 2025). Personalisation of instruction and cooperative smartphone-assisted jigsaw learning are tested as interventions to reduce MA (Awofala, 2017; Awofala, Johnson & Akinoso, 2025). Awofala & Akinoso (2017) explicitly assess the psychometric properties of a mathematics anxiety questionnaire used by preservice teachers in southwest Nigeria. That validation work grounds subsequent correlational and intervention studies by confirming instrument reliability/validity in the Nigerian context.

Several studies situate MA measurement alongside instruments for nomophobia, smartphone addiction, depression, and critical thinking enabling multivariate models (Awofala & Esealuka, 2021; Adebiyi et al., 2024). Research on MA in Nigeria has been conducted with senior secondary students (Awofala & Awolola, 2011; Awofala, 2019; Awofala et al., 2025), preservice/early-childhood teachers (Awofala & Akinoso, 2017; Sopekan & Awofala, 2019), primary teachers and primary pupils (Awofala et al., 2024; Ajao & Awofala, 2024), and undergraduates in calculus (Awofala & Odogwu, 2017). Several studies use predictor models (regression, correlational analysis) to identify variables associated with MA and achievement (Awofala & Awolola, 2011; Awofala et al., 2024). Intervention studies explicitly evaluate change in MA following instructional manipulations (Awofala, 2017; Awofala, Johnson & Akinoso, 2025). Awofala (2017) reports that personalization of instruction influences students' anxiety when solving mathematical word problems indicating instructional design can reduce anxiety associated with applied mathematics tasks. Awofala & Odogwu (2017), and later Awofala et al. (2025), examine cognitive failures alongside MA; the corpus suggests cognitive slips are meaningfully related to MA and may help explain performance decrements.

Sopekan and Awofala (2019) find MA is associated with mathematics beliefs and numeracy skills among early childhood preservice teachers linking affect to both skill and epistemic beliefs. Awofala (2020) examines computer-based testing and shows testing medium influences both achievement and anxiety. Awofala & Esealuka (2021) and Adebiyi et al. (2024) study nomophobia and smartphone addiction; they identify these techno-psychological factors as predictors/correlates of internet addiction and MA respectively indicating modern device dependence can be implicated in mathematical anxiety dynamics. Awofala & Ogunsanya (2025) link depression and fear of COVID-19 to preservice teachers' MA, showing macro stressors and psychological states can exacerbate MA. Awofala, Johnson & Akinoso (2025) report reductions in MA through smartphone-assisted jigsaw cooperative learning among senior high students supporting active, collaborative, technology-enhanced pedagogy as anxiety-reducing. Several descriptive/correlational papers (Awofala, 2019; Okunuga, Awofala & Osarenren, 2020; Awofala & Lawal, 2022) position MA among the constellation of predictors (critical thinking, quantitative reasoning) related to achievement, reinforcing its practical significance.

Methodology

Research Design

The study adopted a descriptive survey design of the ex post facto type. This design was deemed appropriate because the independent variables gender and professional phase had already occurred naturally and could not be manipulated by the researchers. According to Cohen, Manion, and Morrison (2018), descriptive surveys are suitable for gathering detailed information about participants' opinions, attitudes, and characteristics as they exist in their natural setting. The ex post facto design allows for the examination of relationships between variables by comparing naturally occurring groups rather than experimentally assigning participants to conditions. In this study,

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mathematics anxiety was measured as the dependent variable, while gender (male/female) and professional phase (pre-service vs. in-service teachers) served as the independent variables. The descriptive nature of the survey enabled the researcher to determine prevalence rates of mathematics anxiety and describe patterns in the target population. The comparative aspect allowed for testing whether significant differences exist between pre-service and in-service teachers and between genders. The choice of this design aligns with similar studies in the field of mathematics education and teacher affective characteristics (Gresham, 2017; Patkin & Greenstein, 2020), which often employ surveys to capture psychological constructs like anxiety.

Population of the Study

The target population comprised all pre-service teachers enrolled in Bachelor of Science Education (BSc.Ed.) programs in a university and in-service teachers actively teaching in primary or secondary schools in Lagos State, South-West Nigeria. Lagos State was selected for both practical and theoretical reasons: It has a diverse educational landscape with urban and rural schools, enabling generalization across different contexts. It hosts several higher education institutions offering teacher education programs, including universities and colleges of education, which provide access to a robust pool of pre-service teachers. The state is representative of broader national trends in teacher preparation and challenges in mathematics education. Pre-service teachers in this study were defined as undergraduate students enrolled in BSc.Ed. programs, specifically those majoring in mathematics education. In-service teachers were defined as individuals currently teaching mathematics or mathematics-related subjects in primary, junior secondary, or senior secondary schools within Lagos State.

Sample and Sampling Procedure

A total of 167 participants were included in the study, comprising: 127 pre-service teachers and 40 in-service teachers. The sample size was determined based on power analysis recommendations for detecting medium effect sizes in independent samples t-tests with a significance level of 0.05 and a power of 0.80 (Cohen, 1988). This ensured that the study was adequately powered to detect meaningful differences between groups. A multi-stage sampling procedure was employed to ensure representativeness: For pre-service teachers, three teacher education institutions in Lagos State were purposively selected to represent both public and private institutions. For in-service teachers, four Local Government Areas (LGAs) were randomly selected from the state's educational districts. From each LGA, at least three schools were selected using stratified random sampling (urban/rural). Within each institution or school, participants were randomly selected using simple random sampling techniques, such as random number generation or lottery methods. Inclusion criteria include that participant had to be actively enrolled in a teacher education program (pre-service) or currently teaching mathematics or related subjects (in-service). The exclusion criteria include teachers not involved in mathematics teaching were excluded to maintain the focus on mathematics-specific anxiety. 107 males and 60 females participated in the study. Participants' ages ranged from 18 to 45 years, with pre-service teachers mostly between 18–25 years and in-service teachers ranging from 25–45 years. For the in-service teachers, the participants' experience ranged from 1 year to over 20 years and were grouped into five categories (1–5, 6–10, 11–15, 16–20, 20+ years). This stratified and random sampling ensured that the sample was diverse and representative of the target population.

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Research Instrument

The primary instrument for data collection was the Mathematics Anxiety Rating Scale (MARS), specifically the 24-item shortened version developed by Plake and Parker (1982), originally based on Richardson and Suinn's (1972) full-scale MARS. This version was chosen for its brevity, psychometric robustness, and widespread use in similar studies. The 24 items are divided into two subscales: Learning Mathematics Anxiety (LMA): Items measuring anxiety related to learning or understanding new mathematical concepts. Mathematics Evaluation Anxiety (MEA): Items measuring anxiety experienced during mathematics testing or evaluation situations. Each item is rated on a 5-point Likert scale: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree. For positively worded statements, higher scores indicate higher anxiety. For negatively worded items, reverse scoring was applied. Sample Items of MARS include: "I feel nervous when solving a mathematics problem under time pressure." "I get tense when I have to teach a math concept to others."

Validity and Reliability of the Instrument

For Content Validity, the instrument (MARS) was reviewed by three experts in mathematics education and educational psychology to ensure cultural relevance and appropriateness for Nigerian teacher populations. Items were assessed for clarity, comprehensiveness, and alignment with the construct of mathematics anxiety. For Construct Validity, a pilot study was conducted with 30 participants (not part of the main sample). Exploratory factor analysis confirmed the two-factor structure (LMA and MEA), supporting its construct validity. The instrument (MARS) demonstrated high internal consistency, with a Cronbach's alpha coefficient of 0.96, consistent with previous studies (Plake & Parker, 1982). This indicates that the items reliably measure the underlying construct of mathematics anxiety.

Procedure for Data Collection

Approval was obtained from the institutional ethics committee and relevant educational authorities, including the Lagos State Ministry of Education. Permission letters were also obtained from participating institutions and schools. Participants were briefed on the purpose of the study, voluntary nature of participation, and confidentiality measures. Written informed consent was obtained. Data were collected using Google Forms to enhance accessibility and reduce manual errors. In locations with limited internet connectivity, paper-based questionnaires were provided and later digitized. The administration process lasted four weeks, with follow-up reminders sent to ensure a high response rate. Responses were screened for completeness. One participant was excluded due to incomplete responses, resulting in a final sample of 166.

Data Analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 27. Both descriptive and inferential statistics were used to address the research questions. Mean, standard deviation, frequency, and percentage were computed to summarize demographic data and general levels of mathematics anxiety. Participants were classified into low anxiety and high anxiety groups using percentile cut-offs: Scores below the 50th percentile = Low anxiety; Scores at or above the 50th percentile = High anxiety. Independent Samples t-tests was used to compare mean anxiety scores between Pre-service and in-service teachers; and Male and female participants at significance level set at $\alpha = 0.05$. Effect Size (Cohen's d) was calculated to determine the practical significance of observed differences, complementing p-values. Normality was assessed using Shapiro-Wilk tests and histograms. Homogeneity of variance was verified using Levene's test.

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Ethical Considerations

The study adhered to the American Psychological Association (APA) ethical guidelines and local institutional policies. Participants were fully informed about the study's purpose, procedures, risks, and benefits before providing written consent. Personal identifiers were removed, and data were stored on password-protected devices. Participants were informed of their right to withdraw at any stage without consequences. Participation posed minimal risk. However, resources for counseling and stress management were provided for participants reporting severe anxiety. The methodology was carefully designed to balance scientific rigor with practical feasibility. The ex post facto survey design was chosen to ethically and realistically examine variables that cannot be experimentally manipulated (e.g., gender, professional phase). The use of a validated, reliable instrument (MARS) ensured accurate measurement of mathematics anxiety. Multi-stage sampling enhanced representativeness while accommodating logistical constraints across diverse institutions and schools. Online administration via Google Forms minimized data entry errors and facilitated rapid data analysis. Despite its strengths, the methodology has limitations that must be acknowledged: The study captures a snapshot in time (cross-sectional nature), limiting causal interpretations of the relationships among variables. Mathematics anxiety was measured using self-report scales, which may be influenced by social desirability or inaccurate self-perception. Although Lagos State provides a diverse sample, findings may not fully generalize to all Nigerian states or international contexts. Online administration may have excluded participants with limited digital literacy or internet access, although paper-based alternatives mitigated this issue.

Results

Preliminary Analysis

Prior to addressing the main research questions, data were cleaned and screened for accuracy. Missing values were minimal, with only one questionnaire excluded due to incomplete responses, leaving a final sample size of 166 participants. Normality checks were conducted using Shapiro-Wilk tests and visual inspection of histograms and Q-Q plots. Both the pre-service and in-service groups demonstrated approximately normal distributions of mathematics anxiety scores ($p>0.05$). Homogeneity of variance was tested using Levene's test, which confirmed the assumption of equal variances across groups ($p > 0.05$).

Demographic Profile of Participants

Table 1 provides a demographic summary of the participants, including their professional phase, gender, and years of teaching experience for the in-service group.

Table 1. Demographic profile of participants

Demographic Variable	Category	Frequency (f)	Percentage (%)
Professional Phase	Pre-service Teachers	126	75.9%
	In-service Teachers	40	24.1%
Gender	Male	106	63.9%
	Female	60	36.1%
Teaching Experience (In-service only)	1–5 years	10	25.0%
	6–10 years	9	22.5%
	11–15 years	8	20.0%
	16–20 years	7	17.5%
	20+ years	6	15.0%

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The majority of participants were pre-service teachers (75.9%), reflecting the larger population of teacher trainees in Lagos State. Among in-service teachers, years of experience were distributed relatively evenly, providing a balanced representation of novice and veteran educators.

Research Question 1: What is the general level of mathematics anxiety among pre-service and in-service teachers?
To address this question, descriptive statistics were calculated to determine the prevalence of low and high levels of mathematics anxiety across professional phases.

Table 2. Descriptive statistics of the general level of mathematics anxiety among pre-service and in-service teachers

Professional Phase	Low Anxiety	High Anxiety	Total
Pre-service	84 (66.7%)	42 (33.3%)	126
In-service	27 (67.5%)	13 (32.5%)	40
Total	**111 (66.9%)**	**55 (33.1%)**	**166**

Interpretation: Approximately **two-thirds (66.9%)** of all participants reported **low mathematics anxiety**, while **one-third (33.1%)** reported **high anxiety**. The proportion of low versus high anxiety was remarkably similar across professional phases: **Pre-service teachers:** 66.7% low, 33.3% high. **In-service teachers:** 67.5% low, 32.5% high. This finding suggests that mathematics anxiety is a **persistent challenge**, affecting teachers throughout their careers, regardless of teaching experience.

Visualization

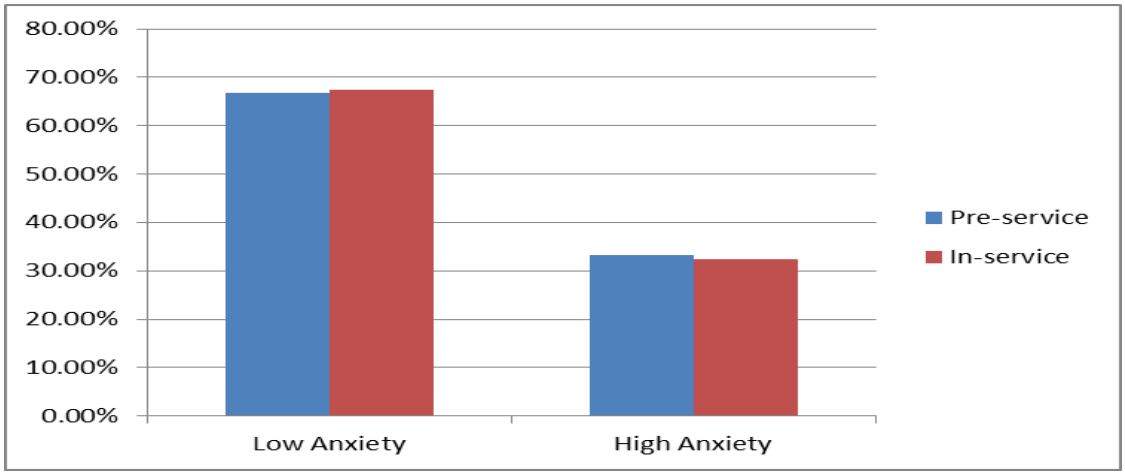

Figure 1. Mathematics Anxiety by Professional Phase

A bar chart (Figure 1) comparing pre-service and in-service teachers revealed nearly **parallel patterns**, underscoring the lack of meaningful difference between the two groups in anxiety prevalence. The uniformity suggests systemic factors, such as cultural attitudes or training practices, may influence anxiety levels equally across career stages.

Hypothesis 1. There is no statistically significant difference in mathematics anxiety between pre-service and in-service teachers.
To determine whether professional phase significantly influenced mathematics anxiety, an **independent samples t-test** was conducted.

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Table 3. t-test analysis of mathematics anxiety by professional phase

Professional Phase	N	Mean (M)	Standard Deviation (SD)	t	p-value	Cohen's d
Pre-service	126	51.79	21.21	1.215	0.226	0.22
In-service	40	46.88	25.46			

Mean Difference: 4.91. **Effect Size (Cohen's d):** 0.22 (small effect)

Interpretation: Although pre-service teachers reported a **slightly higher mean anxiety score** (M = 51.79) compared to in-service teachers (M = 46.88), the difference was **not statistically significant** (p = 0.226). The small effect size (d = 0.22) suggests minimal practical difference between the groups. This result supports the hypothesis that **teaching experience alone may not substantially reduce mathematics anxiety**. Even after years of teaching, many educators continue to experience similar levels of anxiety as those still in training. This finding challenges the assumption that anxiety naturally diminishes as teachers gain experience. It implies that **formal interventions**, rather than passive experience, are necessary to address the emotional dimensions of teaching mathematics.

Hypothesis 2. There is no statistically significant gender difference in mathematics anxiety among all teachers.

A second independent samples t-test was conducted to compare male and female participants across the entire sample.

Table 4. t-test analysis of mathematics anxiety by gender

Gender	N	Mean (M)	Standard Deviation (SD)	t	p-value	Cohen's d
Male	106	52.02	23.25	1.022	0.308	0.17
Female	60	48.31	20.67			

Mean Difference: 3.71. **Effect Size (Cohen's d):** 0.17 (very small effect)

Interpretation: Male teachers exhibited **slightly higher mathematics anxiety** than female teachers on average. However, the difference was **not statistically significant** (p = 0.308), and the effect size was negligible. This contrasts with international literature where females often report higher anxiety levels. In this context, similar educational and cultural experiences may have contributed to **converging anxiety levels** between genders.

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Visualization

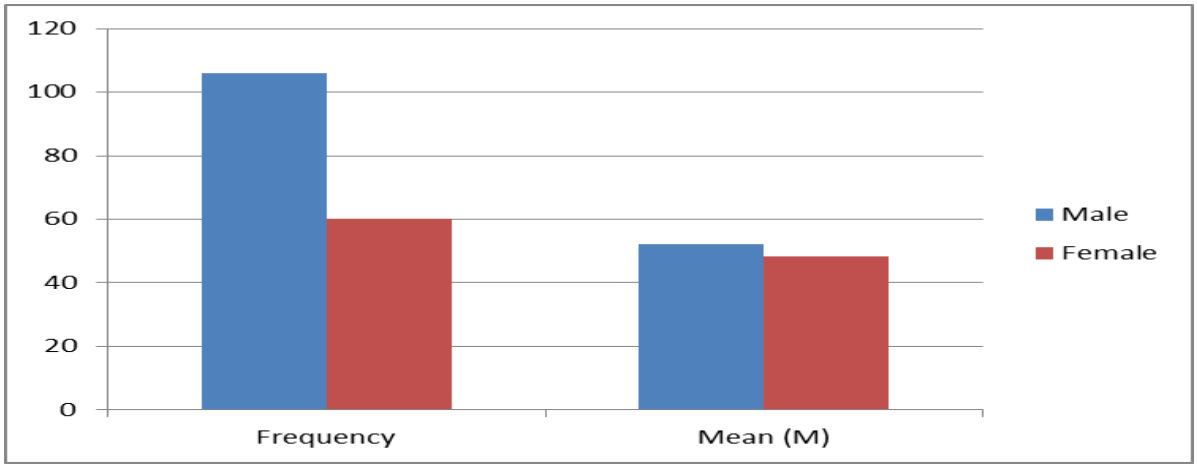

Figure 2. Mathematics Anxiety by Gender

A bar graph (Figure 2) displaying mean scores in mathematics anxiety for male and female participants showed only a marginal difference, visually reinforcing the statistical result of no significant difference in mathematics anxiety of male and female participants.

Hypothesis 3. There is no statistically significant gender difference in mathematics anxiety among pre-service teachers.
To further explore whether gender differences emerged **within professional phases**, two separate t-tests were conducted.

Table 5. t-test analysis of mathematics anxiety by preservice male and female teachers

Gender	N	Mean (M)	Standard Deviation (SD)	t	p-value
Male	83	53.41	22.09	1.108	0.270
Female	43	48.95	19.40		

Interpretation: Among pre-service teachers, males reported **slightly higher mean mathematics anxiety** than females. The difference in mean mathematics anxiety score was **not statistically significant** ($p = 0.270$).

Hypothesis 4. There is no statistically significant gender difference in mathematics anxiety among in-service teachers.

Table 6. t-test analysis of mathematics anxiety by in-service male and female teachers

Gender	N	Mean (M)	Standard Deviation (SD)	t	p-value
Male	23	47.00	26.96	0.036	0.972
Female	17	46.71	24.09		

Interpretation: Among in-service teachers, gender differences were virtually **non-existent** ($p = 0.972$). The mean scores were nearly identical, indicating that **gender plays no significant role in shaping mathematics anxiety** among experienced educators.

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Summary of hypotheses testing showed that (1) There is no statistically significant difference in mathematics anxiety between pre-service and in-service teachers (p=0.226). 2. There is no statistically significant gender difference in mathematics anxiety among all teachers (p=0.308). 3. There is no statistically significant gender difference in mathematics anxiety among pre-service teachers (p=0.270). 4. There is no statistically significant gender difference in mathematics anxiety among in-service teachers (p=0.972). All four null hypotheses were **retained**, indicating that neither professional phase nor gender had a statistically significant effect on mathematics anxiety in this sample.

Patterns and Trends Observed

Approximately one-third of both pre-service and in-service teachers reported high anxiety, suggesting that mathematics anxiety remains constant rather than diminishing with experience. This persistence highlights the inadequacy of current teacher education programs in addressing affective barriers. Contrary to global trends, female teachers did not report significantly higher anxiety. This may reflect cultural factors in Nigeria where both genders face similar academic expectations and professional challenges. Even where differences existed, effect sizes were very small (Cohen's d < 0.30), reinforcing the conclusion that observed differences are practically negligible.

Discussion of Findings

The purpose of this study was to investigate the influence of gender and professional phase (pre-service versus in-service teachers) on mathematics anxiety among a sample of teachers in Lagos State, Nigeria. Mathematics anxiety is a crucial issue because it not only affects the performance and well-being of teachers but also has downstream effects on students' learning outcomes and attitudes toward mathematics (Beilock et al., 2010; Ramirez et al., 2018). The study was motivated by concerns that unresolved teacher anxiety could undermine Nigeria's efforts to improve STEM education, promote gender equity, and enhance teacher effectiveness in mathematics instruction.

General Level of Mathematics Anxiety Among Teachers

The first research question examined the general prevalence of mathematics anxiety among the participants. Results revealed that approximately two-thirds (66.9%) of both pre-service and in-service teachers reported low mathematics anxiety, while about one-third (33.1%) reported high mathematics anxiety. This pattern was consistent across professional phases: Pre-service teachers: 66.7% low anxiety, 33.3% high anxiety. In-service teachers: 67.5% low anxiety, 32.5% high anxiety. This indicates that mathematics anxiety is pervasive but not universal. While many teachers feel relatively confident and calm about mathematics, a significant minority struggle with debilitating anxiety (Awofala & Akinoso, 2017).

The persistence of high anxiety among a sizeable subgroup aligns with Cognitive Interference Theory (Sarason, 1984), which posits that anxiety consumes working memory resources, replacing productive problem-solving with intrusive thoughts such as fear, self-doubt, and worry. Teachers with high anxiety may therefore find it difficult to focus on lesson planning, classroom instruction, or problem-solving tasks, leading to avoidance behaviors and diminished instructional quality. From the perspective of Bandura's Social Cognitive Theory (1986), these findings also reflect issues of self-efficacy. Teachers who lack confidence in their mathematical abilities are more likely to experience anxiety, which in turn negatively influences their teaching performance and their students' perceptions of mathematics. The approximately one-third of teachers with high anxiety may represent those with particularly low mathematics self-efficacy, possibly stemming from negative past experiences or insufficient content knowledge. The observed prevalence closely mirrors findings from both Nigerian and international studies. Arigbabu (2006) found that about

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30–35% of prospective Nigerian teachers reported high mathematics anxiety, suggesting a consistent trend over time. Gresham (2017) reported that one-third of U.S. pre-service teachers exhibited significant anxiety, even after completing teacher education programs.

Patkin and Greenstein (2020) similarly noted that a considerable proportion of in-service teachers in Israel continued to experience anxiety despite years of classroom experience. Collectively, these findings indicate that mathematics anxiety is not merely a transitional challenge faced by students or novice teachers; rather, it is a systemic issue that can persist across career stages and international contexts. The persistence of mathematics anxiety has serious implications. Teachers with high anxiety may avoid using innovative teaching strategies, rely heavily on rote methods, or unintentionally communicate negative attitudes to students. Beilock et al. (2010) demonstrated that students taught by anxious teachers—especially female students—are more likely to develop math anxiety themselves, perpetuating a cycle of fear and underachievement. These findings highlight the urgent need for targeted interventions within teacher education programs to identify and support at-risk teachers before they enter the classroom.

Influence of Professional Phase on Mathematics Anxiety

The second research question investigated whether professional phase—being a pre-service versus in-service teacher—was associated with significant differences in mathematics anxiety levels. Results showed that pre-service teachers had slightly higher mean anxiety scores ($M = 51.79$) than in-service teachers ($M = 46.88$). However, the difference was not statistically significant ($p = 0.226$). The effect size was small (Cohen's $d = 0.22$), indicating limited practical difference between the groups. Thus, teaching experience alone does not significantly reduce mathematics anxiety. This finding suggests that mathematics anxiety is not automatically alleviated by years of teaching practice.

According to Cognitive Load Theory (Sweller, 1988), novice teachers may initially experience higher cognitive demands as they develop instructional fluency. However, the persistence of similar anxiety levels among experienced teachers implies that cognitive overload remains unaddressed, possibly due to systemic stressors such as curriculum pressures, large class sizes, and inadequate resources which characterized the Nigerian mathematics classrooms. From a self-efficacy perspective, these results indicate that experience alone does not guarantee increased confidence. Without deliberate efforts to build mathematics self-efficacy through professional development, even veteran teachers may continue to harbor anxiety. These results are consistent with other studies. Gresham (2017) reported no significant difference in mathematics anxiety between pre-service and in-service teachers in the U.S., concluding that experience alone is insufficient to reduce anxiety. Patkin and Greenstein (2020) found that in-service teachers with specialized mathematics education had lower anxiety than those without, suggesting that professional development, rather than experience per se, is the key factor.

Olson and Stoehr (2019) highlighted that many pre-service teachers enter training programs with pre-existing anxiety and that without intervention, this anxiety persists into their teaching careers. These studies collectively suggest that teacher education programs must actively address affective factors, rather than assuming that confidence will naturally emerge with time. The lack of difference between pre-service and in-service teachers has important implications for teacher education and professional development. Teacher preparation programs should include explicit modules on anxiety reduction, emotional resilience, and mathematics self-efficacy building.

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Professional development should not end at graduation. In-service teachers need ongoing opportunities to reflect on their emotional experiences, update their pedagogical skills, and receive peer mentoring. Policymakers must address structural factors—such as inadequate resources and curriculum overload—that perpetuate stress and anxiety among teachers at all career stages.

Gender and Mathematics Anxiety

The third research question explored whether gender differences existed in mathematics anxiety among teachers. Male participants reported slightly higher mean anxiety (M = 52.02) than female participants (M = 48.31). However, this difference was not statistically significant (p = 0.308). Separate analyses within professional phases also found no significant gender differences. For pre-service teachers: p = 0.270 and for In-service teachers: p = 0.972. These results challenge the traditional stereotype that mathematics anxiety is predominantly a female issue. In many Western contexts, females have been found to report higher anxiety due to socialization processes that portray mathematics as a masculine domain (Luttenberger et al., 2018; Hart & Ganley, 2019). The absence of gender differences contrasts with global meta-analyses that typically report higher female anxiety (Hart & Ganley, 2019). This discrepancy may reflect contextual factors in Lagos State, such as shared educational pathways and cultural expectations for both genders. However, in this Nigerian context, both genders appear to face similar educational pressures and cultural expectations, leading to comparable levels of anxiety. From a Social Cognitive Theory perspective, this suggests that both male and female teachers may have internalized similar beliefs about mathematics and teaching, resulting in equivalent self-efficacy levels and anxiety experiences. The absence of gender differences contrasts with many international studies. Hart and Ganley (2019) and Suárez-Pellicioni et al. (2015) reported consistent female-male gaps in mathematics anxiety across multiple countries. Meta-analyses have also confirmed that, globally, females tend to report higher anxiety, even when performance is equal (Hembree, 1990). However, other research supports the current findings. Patkin and Greenstein (2020) found negligible gender differences in certain cultural contexts, particularly where male and female teachers had similar training and responsibilities. Arigbabu (2006) reported mixed patterns of gender differences among Nigerian pre-service teachers, suggesting that local cultural factors play a significant role. Several factors may explain the lack of gender difference in this study. In Nigeria, male and female teacher trainees often study in the same programs with similar curricula and expectations, reducing gender-based disparities. Increasing gender equity initiatives may have narrowed traditional gaps in mathematics confidence and participation. The relatively balanced gender distribution and shared cultural context of participants may have minimized variability.

The study's findings can be understood through the three guiding theories. Bandura's Social Cognitive Theory: The persistence of mathematics anxiety across genders and career stages highlights the central role of self-efficacy beliefs. Teachers who lack confidence in their mathematical abilities are more likely to experience anxiety, which in turn affects their instructional practices and their students' outcomes. This underscores the need for teacher education programs to foster positive self-efficacy through mastery experiences, vicarious learning, and supportive feedback. Cognitive Interference Theory: The approximately one-third of teachers with high anxiety are likely experiencing working memory overload during mathematical tasks. Intrusive thoughts such as fear of failure or negative self-talk interfere with cognitive processing, leading to errors and avoidance behaviors. This mechanism explains why anxiety persists even among knowledgeable teachers. Cognitive Load Theory: Pre-service teachers face especially high cognitive demands as they simultaneously learn content, develop pedagogical skills, and manage classroom

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dynamics. Without adequate support, this cognitive load can trigger or exacerbate anxiety. However, the similar anxiety levels among in-service teachers suggest that systemic stressors, such as large class sizes and curriculum pressures, maintain high cognitive loads throughout teachers' careers.

Implications for Practice and Policy

Teacher Education Programs should integrate anxiety-reduction strategies into coursework, such as mindfulness, expressive writing, and cognitive restructuring. The programme should provide opportunities for early mastery experiences, allowing pre-service teachers to build confidence through small, scaffolded teaching tasks. It should include reflective practice modules to help teachers identify and address their emotional responses to mathematics. Professional Development for In-service Teachers should establish ongoing peer mentoring networks where teachers can share strategies and support each other. Offer content-focused workshops to strengthen mathematical knowledge and reduce anxiety linked to content gaps. Provide emotional resilience training, addressing stress management and coping skills. The Policy-Level Actions should incorporate measures of teacher well-being, including mathematics anxiety, into national education quality frameworks. Fund research and intervention programs focused on affective dimensions of teaching, not just academic outcomes. Address systemic stressors such as overcrowded classrooms, inadequate resources, and unrealistic curriculum demands. This study contributes to the global literature on mathematics anxiety in several ways. It provides rare empirical data from Nigeria, a context underrepresented in the literature. By comparing pre-service and in-service teachers, it clarifies that experience alone does not mitigate anxiety. It challenges the assumption of universal gender differences, highlighting the importance of cultural context. It demonstrates how self-efficacy, cognitive interference, and cognitive load interact to shape teacher anxiety.

Limitations and Future Research

The study captures a single point in time, limiting causal interpretations. Participants may have under- or over-reported their anxiety levels. Findings may not generalize to all Nigerian states or international contexts. This study did not track teachers over time to observe changes in anxiety as they transition from pre-service to in-service roles. Future research should combine quantitative surveys with qualitative interviews to gain deeper insights into personal experiences of anxiety. There should be intervention trials to test the effectiveness of anxiety-reduction programs in teacher education and professional development settings.

Conclusion

Mathematics anxiety is a complex, multifaceted issue that affects not only learners but also those responsible for teaching them. In the Nigerian context, where educational reforms aim to improve STEM education and national competitiveness, addressing teacher mathematics anxiety is critical. By examining the influence of gender and professional phase, this study contributes to a deeper understanding of how anxiety develops and persists within the teaching profession. Ultimately, the goal is to inform strategies that will empower teachers, enhance instructional quality, and break the cycle of fear and underachievement surrounding mathematics. This study provides compelling evidence that mathematics anxiety is a pervasive and persistent challenge among Nigerian teachers, affecting approximately one-third of both pre-service and in-service educators. Neither professional phase nor gender has a significant impact on anxiety levels, suggesting that the roots of anxiety lie in broader systemic and cultural factors. Without deliberate, targeted interventions, anxiety will likely persist across generations, potentially undermining mathematics teaching quality and student outcomes. Contrary to global trends, no significant gender differences were observed,

suggesting that cultural and systemic factors may override traditional stereotypes in this context. The findings emphasize that teaching experience alone is insufficient to reduce anxiety, targeted interventions are essential. By addressing the affective dimensions of teaching alongside content and pedagogy, teacher education programs and policymakers can break the cycle of mathematics anxiety, ultimately improving both teacher well-being and student outcomes.

Despite growth in MA research, several gaps remain: More longitudinal studies are needed to ascertain whether and how MA changes across the pre-service → in-service transition under routine teacher education and professional development practices. Existing cross-sectional comparisons are informative but cannot fully trace causal trajectories. While mediation studies implicate student perceptions in the teacher-to-student MA pathway, experimental interventions targeting teacher affect and observing student outcomes longitudinally would strengthen causal claims (Hembree, 1990). Most high-quality intervention trials have taken place in Western higher-income settings. There is a need for culturally adapted intervention research (expressive writing, mindfulness, PCK workshops) in Nigerian and other African contexts to evaluate feasibility and effectiveness. The present study helps justify this localized focus. Rather than treating gender as a fixed predictor, future research should study how gender interacts with teacher training, departmental culture, and policy (e.g., single-sex teacher training cohorts, mentorship) to produce differential MA trajectories. Mixed-methods studies can unpack why gender gaps appear in some contexts but not others.

Synthesizing the literature suggests that MA is a robust predictor of poorer math outcomes and less effective instructional practices, and that teachers' MA matters for student achievement and for perpetuation of gendered math beliefs. Interventions especially those combining affective and content approaches to reduce MA and improve performance, but context matters. The present study's findings (no significant gender or professional-phase differences, but ~33% high MA) align with global trends showing heterogeneity and highlight the local need for targeted, evidence-based teacher preparation and professional development in Lagos State and similar settings. By situating this local evidence within the broader international literature, the case for integrating affective components (e.g., expressive writing, mindfulness, content reinforcement) into teacher education becomes clear.

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