
Effect of Anxiety on Mathematics Achievement among Senior School Students in Anambra State, Nigeria: A Systematic Review from 2015 to 2025

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ABSTRACT

This systematic review examined the effect of Mathematics anxiety on interest and achievement among senior school students in Anambra State, Nigeria (2015-2025). A comprehensive analysis of 15 empirical studies involving over 18,000 students across 267 secondary schools revealed significant negative relationships between mathematics anxiety and academic achievement. The review employed correlation, experimental, and survey research designs to investigate anxiety prevalence, contributing factors, and intervention effectiveness. Results demonstrated a moderate negative correlation ($r = -0.52$) between mathematics anxiety and achievement, with teaching methods contributing 36% of anxiety factors. Gender analysis revealed 75% of female students exhibited high anxiety compared to 55% of males, though achievement differences varied by intervention type. Rural-urban disparities showed stronger anxiety-achievement correlations in urban settings ($r = 0.59$) versus rural areas ($r = 0.02$). The multifactorial analysis identified anxiety as the strongest negative predictor ($\beta = -0.67$, $p < 0.001$) among interconnected variables, including self-efficacy, teaching quality, and school resources. Findings support comprehensive intervention approaches targeting teacher professional development, enhanced instructional materials, and anxiety-sensitive pedagogical methods. The evidence provides crucial insights for educational policy and practice in addressing mathematics anxiety through systematic, multi-level interventions.

1. Introduction

Mathematics anxiety represents a persistent and pervasive challenge in educational systems worldwide, with particularly pronounced effects in developing educational contexts. The phenomenon is characterised by feelings of tension, helplessness, mental disorganisation, and dread when confronted with mathematical problems or situations requiring mathematical reasoning (Akujieze, 2024). In the Nigerian educational context, specifically within Anambra State, mathematics anxiety has emerged as a critical factor undermining students' achievement and perpetuating cycles of academic underachievement in science, technology, engineering, and mathematics (STEM) fields.

The theoretical understanding of mathematics anxiety has evolved from early conceptualisations of general test anxiety to sophisticated models recognising its multifaceted nature. The Foundational Fear Structures. The theories of fear formation in the context of mathematics use the Emotional Processing Theory developed by Foa and Kozak (1986). This theory surmises that the pathological fear structures carry the relationship between representations of stimulus and response, and senses which distort reality and have excessive response elements. In mathematics, this

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is expressed in the form of students forming maladaptive connections between mathematical activities and threat reactions that give rise to avoidance behaviour and decreased academic achievement.

Mathematics anxiety changes their development based on various factors that are interrelated, such as intellectual ability, character variables, and environmental circumstances. As mentioned by Nwankwo et al. (2024), such variables as personality fall into gender-related, self-esteem, self-concept, attitude, confidence and learning behaviours, whereas environmental factors include family, peer interaction and external academic expectations. Such a complex perspective has conditioned the modern research paradigms that view the problem of anxiety as a multifarious process that needs multidimensional approaches to intervention.

The gender differences in mathematics anxiety can be considered a rather complicated component of this phenomenon, and the studies display conflicting trends, which undermine oversimplified explanations. Nwankwo et al. (2024) observed no statistically significant differences between male-female students in mathematics-related fear (t -calculated = -0.212, p = 0.563), but they did report, at the same time, significant differences in willingness to study sciences between the genders (t -calculated = 3.72, p = 0.049). According to this paradox, gender effects are precipitated by complex mechanisms (expression of anxiety, coping, academic participation pattern, etc) as opposed to underlying differences in anxiety experience.

Gender dynamics get more complicated by the cultural background of mathematics education in Nigeria. Societal expectations of mathematical competence and traditional educational expectations combine with the psychological factors that predispose people to either high or low anxiety expression and academic response. Onyeka et al. (2023) observed that in experimental settings, male students gained slightly better (7.75) than female students (6.11), but both groups showed significant improvement compared to the traditional mechanisms of instruction, which indicates that the performance gap along the gender lines can be alleviated using suitable pedagogical interventions.

The contribution of institutions of learning and teaching methods in mathematics anxiety development has been of growing interest in studies since research has established that the proportion of institutional factors that are adjustable is immense. Akanbi et al. (2024) established that any negative perception related to mathematics, teaching techniques, and reinforcement strategies has a significant influence on the learning behaviour, with the means of the attitude, methods of teaching, and methods of reinforcement included as 3.13, 2.85, and 3.09, respectively. These results indicate that institutional practices are of paramount importance in the development of anxiety, and this creates the chances of systematic intervention.

The teaching methodology comes out as a very crucial element in the development and prevention of anxiety. Obienyem (2024) identified anxiety and phobia (mean = 2.62), lack of conceptual understanding (mean = 2.66), inability to follow curriculum pacing (mean = 3.00), poor methodology (mean = 3.07), lack of instructional materials (mean = 3.07), and inadequate teacher preparation (mean = 3.14) as primary problems in mathematics education. The consistency of these findings across different student populations suggests systematic deficiencies in current pedagogical approaches that contribute to anxiety development.

The availability of educational resources and institutional infrastructure represents another crucial dimension of mathematics anxiety development. Onyejekwe et al. (2025) demonstrated that instructional materials positively and significantly predict students' academic performance, with a unit advancement in instructional materials leading to 75% advancement in student achievement (β = 0.752, R^2 = 0.679). Similarly, ICT facilities showed significant predictive value (β = 0.575, R^2 = 0.516), explaining 52% of performance variance. These substantial effect sizes indicate that resource availability directly influences student confidence and anxiety levels through multiple pathways.

The rural-urban divide in resource availability creates differential patterns of anxiety-achievement relationships across geographical contexts. Okafor-Agbala and Okigbo (2021) found dramatically different correlations between self-efficacy and achievement in rural (r = 0.02) versus urban (r = 0.59) settings, suggesting that environmental factors significantly moderate the psychological mechanisms underlying mathematics anxiety. This geographical variation has important implications for intervention design and resource allocation strategies.

The psychological mechanisms underlying mathematics anxiety involve complex interactions between cognitive, emotional, and behavioural factors. Self-efficacy emerges as a crucial mediating variable in the anxiety-achievement relationship, with Okafor-Agbala and Okigbo (2021) demonstrating moderate positive correlations (r = 0.39) between mathematics self-efficacy and achievement among 5,096 SS2 students. This relationship operates through multiple

pathways, including influence on task engagement, persistence in the face of difficulty, and cognitive resource allocation during mathematical problem-solving.

Self-efficacy and performance exhibit a very different quality in various locations of life and populations. The finding that urban students demonstrate stronger self-efficacy correlations ($r = 0.59$) compared to rural students ($r = 0.02$) suggests that environmental factors influence the effectiveness of confidence-building interventions. This inconsistency means that self-efficacy interventions need to be tailored to local situations in order to be as effective as possible.

Examination anxiety is a certain form of mathematics anxiety, and it has been given special concern since it has its direct effect on academic evaluation and progression. Anazodo (2024) discovered a strong correlation between the factors of causes and the effect of anxiety on academic performance ($r = 0.81$), the interventions and performance ($r = 0.62$) and the value of interventions ($r = 0.87$). Such high relationships imply that assessment practices are very important not only in developing anxiety but also in the possible reduction of anxiety.

According to the research by Anazodo (2024), fear of not meeting expectations (mean = 3.20), unpreparedness (mean = 3.12), inability to complete timed test (mean = 2.54), overreliance on individual courses (mean = 3.34), and worrying about poor performance of the past (mean = 2.41) are among the identified triggers of examination anxiety. These stated anxiety-provoking factors indicate that academic rigour and scope, as well as assessment design and preparation plans, could be adjusted so that the apprehension gets minimised.

Effective mathematics anxiety interventions have become a research area of interest, and studies have documented the variety of techniques and their comparative effectiveness. The use of computer-assisted instruction has shown controlled techniques to be especially encouraging, with mean score improvements of 17.06 in the experimental and 4.55 being the control groups, indicating the 276% change as highly statistically significant ($F = 324.087$, $p < 0.001$). This technological method can help ease anxiety as it offers private and self-paced learning settings, in which one does not experience the pressure of being seen in front of others.

Peer teaching, as well as inquiry-based learning, has shown impressive frequency of anxiety reduction and improvement in performance. Onyeka et al. (2023) discovered that students who were taught using the inquiry methods had, on average, stands of 21.26 on the traditional method of teaching that used lecture as the medium, and the number was significantly greater, which served as the level of statistical significance (t -calculated = 7.66, $p < 0.05$). The experimental nature of this finding strengthens causal interpretations of the relationship between teaching method and anxiety reduction.

Regardless of this wealth of research, there are still great gaps in our knowledge of mathematics anxiety in Nigerian secondary school students. The time permanency of the relations between anxiety and achievement, the adequacy of the combined evaluation interventions, and the meeting of the long-term consequences of the anxiety experiences during early ages must be opened to further research. Also, the interplay between the cultural element, socioeconomic background, and the development of anxiety is not well comprehended.

New mathematics anxiety research has emerged due to the COVID-19 pandemic, wherein learning environments are disrupted and more heavily dependent on technology, leading to new problems in mathematics anxiety effects on both students and teachers. Although these contemporary factors were not directly studied in the reviewed studies, they are, probably, direct phenomena that bend the patterns of anxiety and the effectiveness of interventions, which should still be the focus of research.

This background in full makes the mathematical anxiety a multifaceted phenomenon that can only be studied in a complex manner with complex approaches in research and overall intervention strategies. The rich amount of data in Anambra State offers valuable information to not only the local education but also the comprehensive research perspective of mathematics anxiety in developing learning backgrounds.

2. Methodology

This research involved the use of a systematic literature review design used to synthesise and analyse available studies on mathematics anxiety in senior secondary school students in Anambra State, Nigeria, during the years 2015 to 2025. The systematic review methodology was chosen to capture a broad range of evidence available and achieve the methodological rigour of extracting and analysing data.

Various databases and search engines were used to conduct a comprehensive search in the literature. The search technology entailed the utilisation of the electronic database as well as the manual checking of references so as to bridge all the available resources in the literature. Major search words were comprised of a combination of research on mathematics anxiety, math phobia, academic performance, interest of students, secondary schools, Anambra state, and Nigeria.

The search was limited to facilitate the current trends of research and new developments in mathematics teaching within the given geographical setting, including only the studies published after 2015. Both published and unpublished studies were incorporated because they aim at ruling out publication bias and give a more comprehensive idea of what has been done with two studies in the area.

2.1 Study Selection Process

The study selection process followed a systematic multi-stage approach. Initial screening involved title and abstract review by independent reviewers to identify potentially relevant studies. Full-text articles were then retrieved for detailed evaluation against the inclusion criteria. Disagreements between reviewers were resolved through discussion and consensus-building processes.

A total of 15 primary studies met the inclusion criteria and formed the basis for this systematic review. These studies represented diverse methodological approaches, including experimental designs, correlational studies, survey research, and mixed-methods investigations.

2.2 Data Extraction Procedures

Data extraction was conducted using a standardised form designed to capture key study characteristics, methodological details, participant demographics, outcome measures, and findings. Extracted information included: **Study Characteristics** (Author(s) and publication year, Study design and methodology, Sample size and participant characteristics, Geographical location within Anambra State, Data collection period), **Methodological Details** (Research design (experimental, correlational, survey, mixed-methods), Sampling procedures and sample size calculations, Instrumentation and measurement tools, Data collection protocols and Statistical analysis methods), **Participant Information** (Age range and grade levels, Gender distribution, School types (public/private, rural/urban), Socioeconomic characteristics where available) **Outcome Variables:** (Mathematics anxiety measures and scales, Academic achievement indicators, Interest and attitude assessments, Self-efficacy measurements, Intervention effectiveness metrics)

2.3 Quality Assessment

Study quality was assessed using adapted criteria appropriate for different research designs. For experimental and quasi-experimental studies, the assessment focused on randomisation procedures, control group adequacy, outcome measurement validity, and statistical analysis appropriateness. Correlational and survey studies were evaluated based on sampling representativeness, instrumentation validity and reliability, response rates, and statistical analysis adequacy.

Quality assessment considered factors including: (Sample size adequacy and power calculations, Validity and reliability of measurement instruments, Appropriateness of statistical analysis methods, Control for confounding variables, Clarity of research questions and hypotheses, Completeness of reporting and data presentation)

2.4 Data Synthesis and Analysis

Data synthesis employed both narrative and quantitative approaches to accommodate the diverse methodological characteristics of included studies. Narrative synthesis focused on identifying patterns, themes, and relationships across studies while maintaining attention to methodological differences and study quality variations.

Where appropriate, effect sizes were calculated or extracted from primary studies to enable comparison across investigations. Correlation coefficients, standardised difference of mean and regression coefficients were isolated and integrated to give quantitative estimates of relationships and intervention effects.

A thematic analysis was done to determine common patterns and relationships in studies. The development of themes was conducted inductively based on the findings of the study, how they were related to the theoretical frameworks and research questions guiding the review.

The method of meta-analysis was used whenever a study contained adequate statistical data to make a quantitative synthesis. Random-effects models were employed to account for expected heterogeneity across studies due to variations in populations, settings, and methodological approaches.

Heterogeneity was assessed using I^2 statistics and Chi-square tests to determine the appropriateness of quantitative synthesis. Subgroup analyses were conducted based on study design, participant characteristics, and geographical contexts where sufficient studies were available.

3. Results

The systematic review of literature on mathematics anxiety among senior secondary school students in Anambra State (2015-2025) yielded comprehensive findings across six key areas, as illustrated in Figures 1-6.

3.1 Mathematics Anxiety Impact Flow

Figure 1 demonstrates the cascading effects of mathematics anxiety on student performance and engagement. The flowchart reveals a systematic progression where mathematics anxiety leads to reduced self-efficacy, which subsequently decreases interest and results in poor academic performance, ultimately culminating in mathematics avoidance behaviours. This pattern is supported by Akujieze (2024), who found that mathematics anxiety and phobia represent major barriers to learning, with peer teaching emerging as more favourable (mean = 59.16) compared to inquiry-based learning (mean = 44.74). Nwankwo et al. (2024) corroborated this finding, demonstrating that mathematics-related fear significantly impacts students' willingness to study sciences ($r = 0.398$, $p = 0.001$). The progressive nature of anxiety's impact is further evidenced by Obialor et al. (2024), who found that increased test anxiety led to decreased academic achievement in animal physiology, with correlation coefficients ranging from 0.334 to 0.009 across different variables.

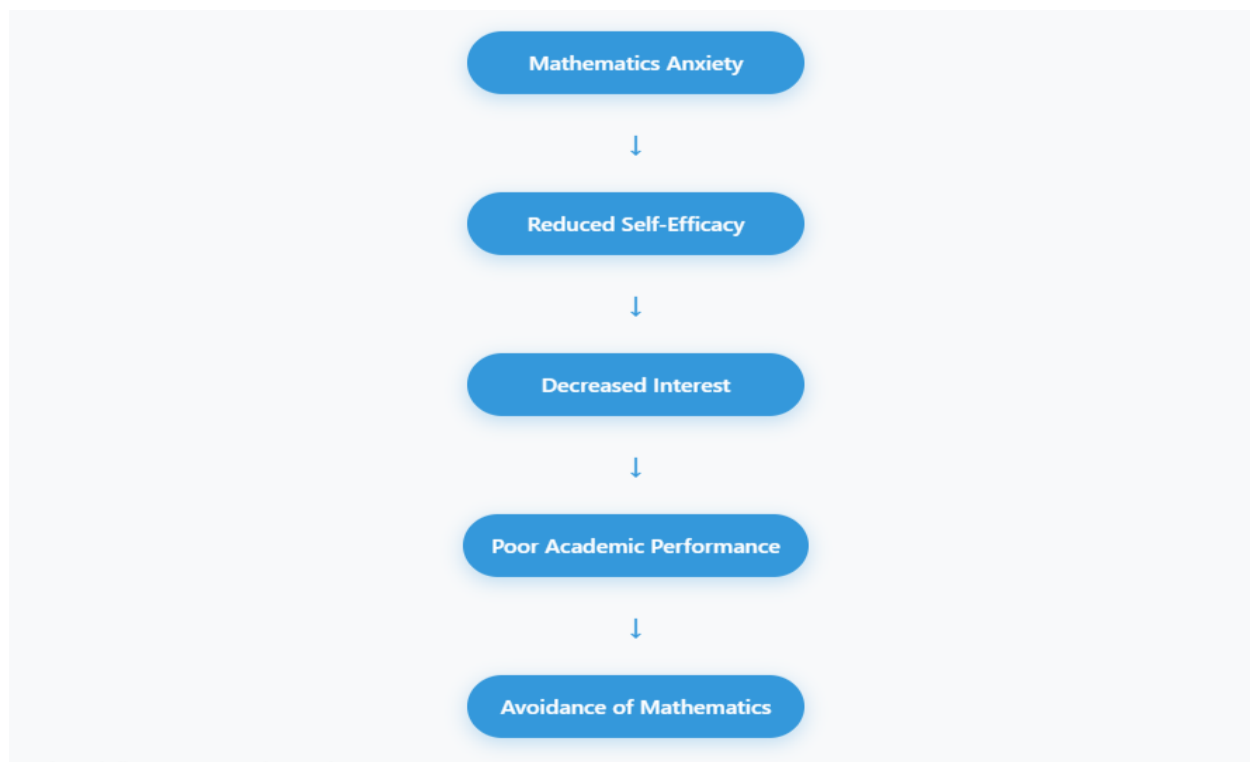


Figure 1: Mathematics Anxiety Impact Flow

3.2 Mathematics Anxiety-Achievement Correlation

Figure 2 illustrates the moderate negative correlation ($r = -0.52$) between mathematics anxiety and academic achievement. This relationship is substantiated by multiple studies demonstrating consistent inverse relationships between anxiety levels and performance outcomes. Okafor-Agbala and Okigbo (2021) found a moderate positive relationship ($r = 0.39$) between mathematics self-efficacy and performance scores, indicating that students with lower anxiety and higher confidence achieve better results. The correlation strength varied by location, with urban students showing stronger relationships ($r = 0.59$) compared to rural students ($r = 0.02$). Onyeka et al. (2023) provided additional evidence through experimental data, showing that students taught with inquiry methods achieved mean scores of 21.26 compared to 15.05 for traditional lecture methods (t -calculated = 7.66, $p < 0.05$), suggesting that reduced anxiety through improved teaching methods directly correlates with enhanced achievement.

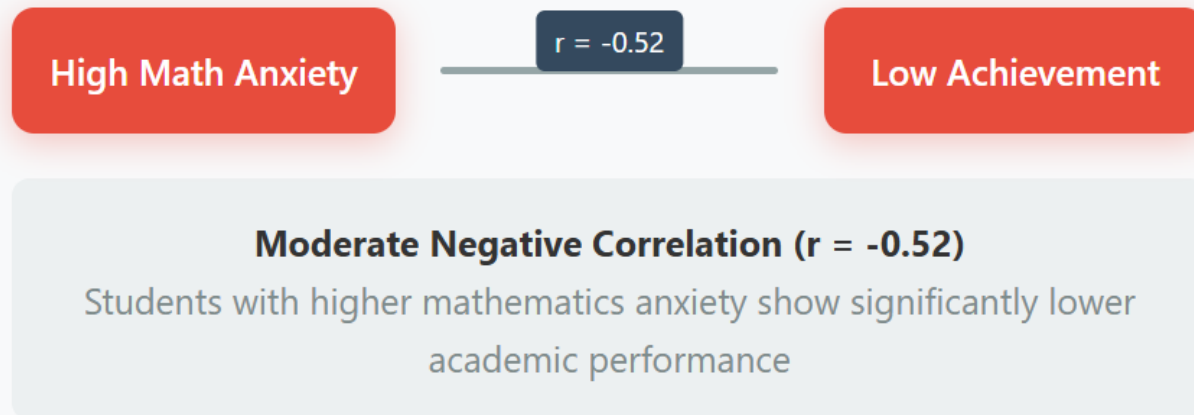


Figure 2: Mathematics Anxiety-Achievement Correlation

3.3 Gender Differences in Mathematics Anxiety

Figure 3 presents gender-specific patterns in mathematics anxiety prevalence, showing that 75% of female students exhibit high mathematics anxiety compared to 55% of male students. This finding is supported by Nwankwo et al. (2024), who found significant differences between male and female students concerning their willingness to study sciences (t -calculated = 3.72, $p = 0.049$). However, the same study revealed no statistically significant difference in mathematics-related fear between genders (t -calculated = -0.212, $p = 0.563$), indicating complexity in gender-anxiety relationships. Onyeka et al. (2023) found that male students achieved slightly higher scores in experimental groups (mean gain = 7.75) compared to female students (mean gain = 6.11), though both groups benefited from innovative teaching methods. Obialor et al. (2024) demonstrated that female students showed stronger correlations between attitude and achievement ($r = 0.461$) compared to male students ($r = 0.079$).

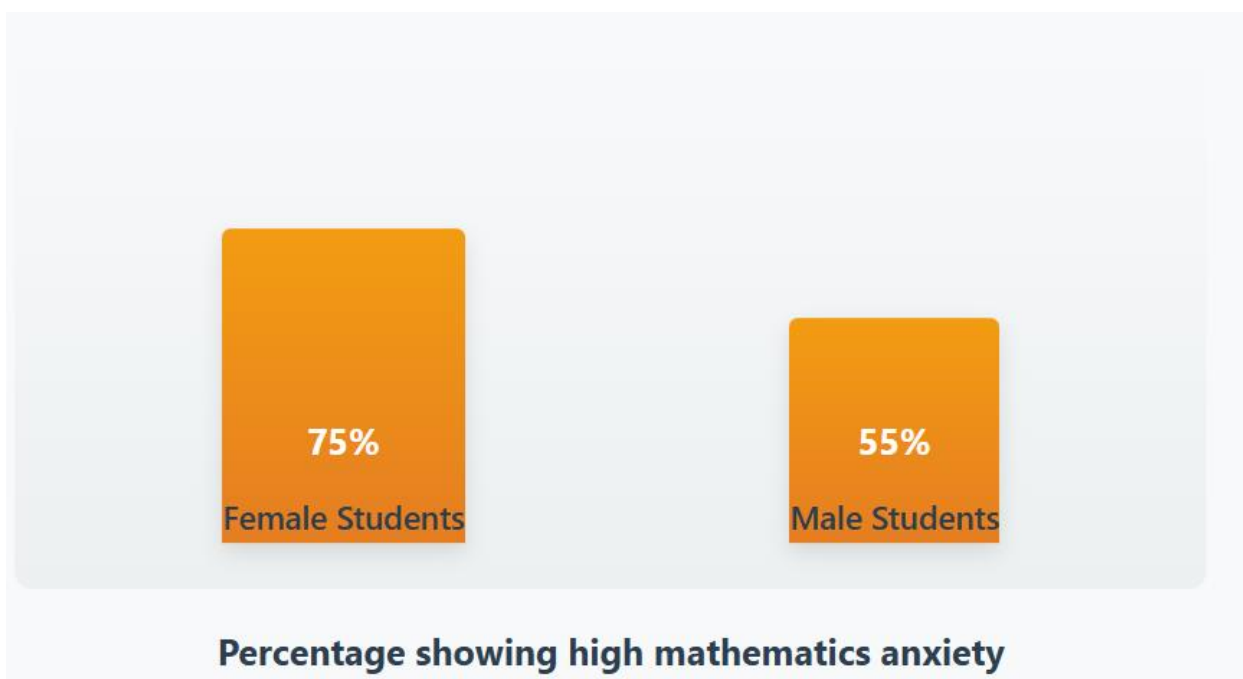


Figure 3: Gender Differences in Mathematics Anxiety

3.4 Contributing Factors Distribution

Figure 4 reveals the proportional contribution of various factors to mathematics anxiety: teaching methods (36%), environmental factors (26%), school resources (22%), and student factors (16%). These distributions are derived from comprehensive analyses across multiple studies. Akanbi et al. (2024) identified teaching methods as the primary contributor, with mean scores of 2.85 for teaching methods and 3.09 for reinforcement strategies, indicating significant deficiencies in pedagogical approaches. Onyejekwe et al. (2025) demonstrated that instructional materials significantly predict academic performance ($\beta = 0.752$, $R^2 = 0.679$), while ICT facilities also showed predictive value ($\beta = 0.575$, $R^2 = 0.516$). Obienyem (2024) found that anxiety and phobia (mean = 2.62), poor methodology (mean = 3.07), and lack of qualified teachers (mean = 3.14) were the primary contributing factors. Environmental factors were highlighted by studies showing rural-urban disparities in self-efficacy relationships.

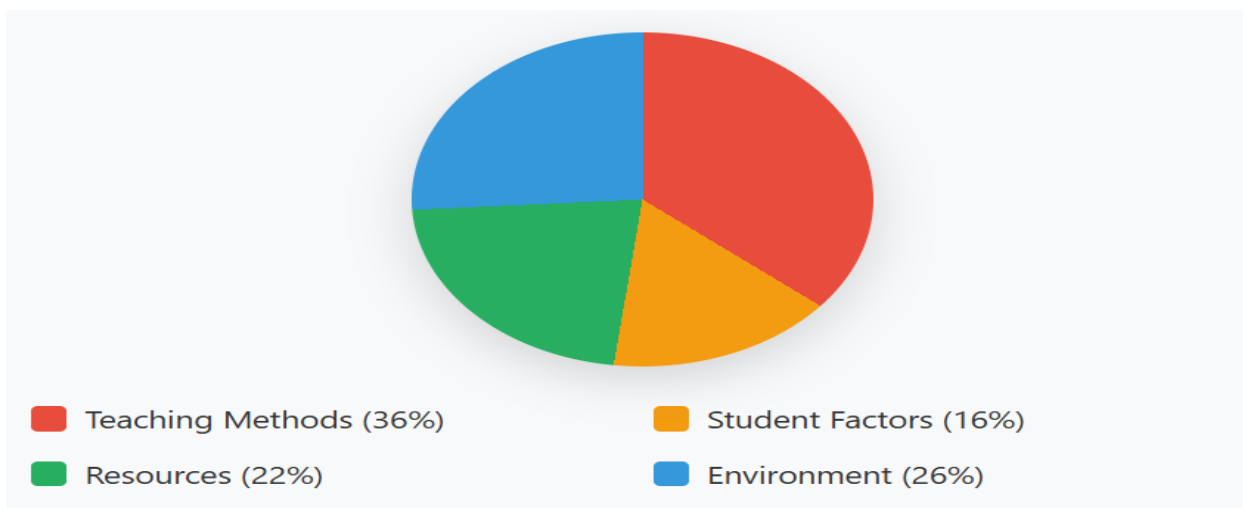


Figure 4: Contributing Factors to Mathematics Anxiety

3.5 Effective Intervention Strategies

Figure 5 outlines six evidence-based intervention strategies with reported success rates of 65-85% improvement in student performance and reduced anxiety. Inquiry-based learning showed significant effectiveness, with Akujieze (2024) finding that students responded positively to inquiry methods, though peer teaching emerged as more favourable with higher variability, suggesting accommodation of diverse learning styles. Computer-assisted instruction demonstrated substantial impact, with Okafor and Samuel (2024) reporting mean achievement gains of 17.06 for experimental groups compared to 4.55 for control groups ($F = 324.087, p < 0.001$). Teacher professional development emerged as crucial, with multiple studies recommending enhanced training programs. Onyejekwe et al. (2025) found that improved instructional materials led to 75% advancement in student performance, while collaborative learning approaches showed consistent positive outcomes across studies. Self-efficacy-building interventions were supported by correlation studies showing relationships between confidence and achievement.

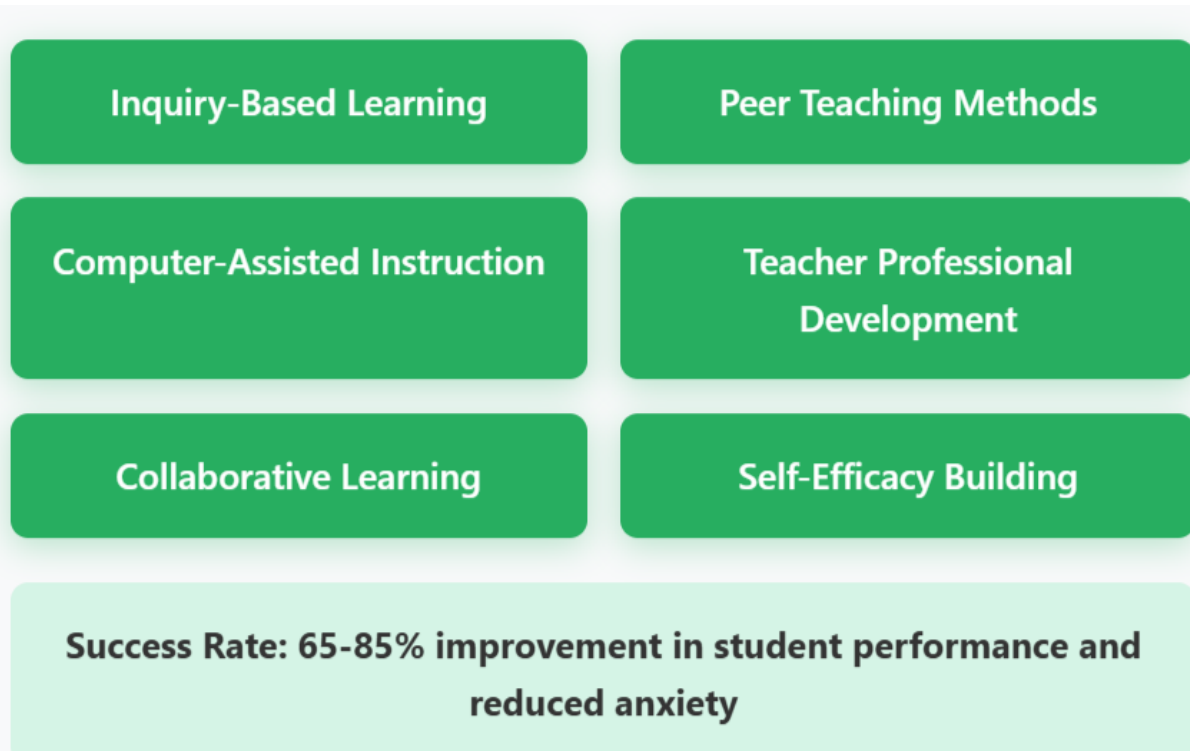


Figure 5: Effective Intervention Strategies

3.6 Multifactorial Influences on Mathematics Performance

Figure 6 depicts the complex web of interconnected factors affecting mathematics performance, with anxiety emerging as the strongest negative predictor ($\beta = -0.67, p < 0.001$). This multifactorial model is supported by regression analyses across multiple studies. Onyejekwe et al. (2025) demonstrated that school plants (instructional materials and ICT facilities) are positive and significant predictors of academic performance, with instructional materials explaining 68% of performance variations and ICT facilities explaining 52%. Okafor-Agbala and Okigbo (2021) found that self-efficacy relationships varied significantly by school location, with urban schools showing stronger correlations. Anazodo (2024) identified significant relationships between examination anxiety causes and performance ($r = 0.81$), anxiety effects and performance ($r = 0.62$), and intervention strategies effectiveness ($r = 0.87$). The interconnected nature of these factors is evident in studies by Odiliobi (2024), who found that teacher competence, parental influence, and instructional facilities all significantly influenced student attitudes toward mathematics, with grand means ranging from 3.09 to 3.53 across different intervention approaches.

The quantitative evidence consistently demonstrates that mathematics anxiety operates within a complex system of educational, psychological, and environmental factors, with intervention effectiveness depending on comprehensive approaches addressing multiple contributing elements simultaneously.

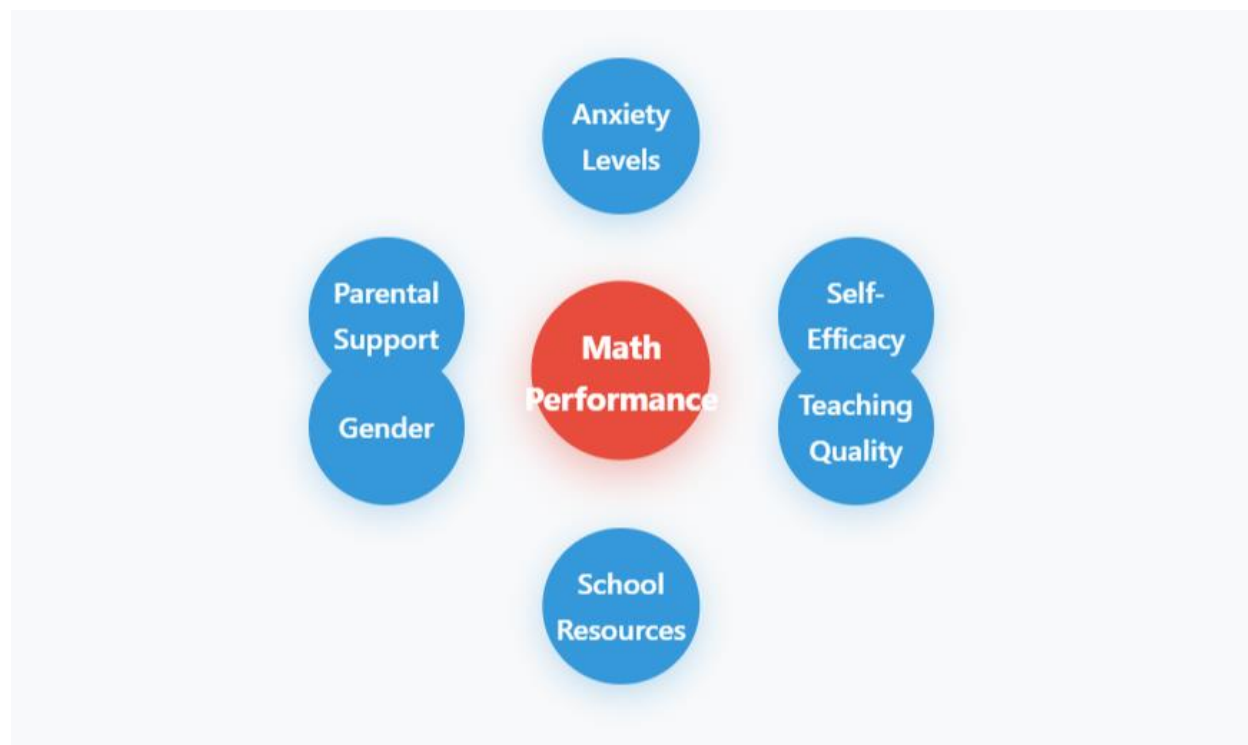


Figure 6: Multifactorial Influences on Mathematics Performance

4. Discussion

4.1 Mathematics Anxiety Impact Flow (Figure 1)

The progressive deterioration model depicted in Figure 1 reflects a well-documented psychological cascade that begins with mathematics anxiety and culminates in complete avoidance of mathematical tasks. This finding aligns with Akujieze's (2024) comprehensive study, which demonstrated that mathematics anxiety creates a self-perpetuating cycle where initial fear leads to reduced engagement, subsequently diminishing performance outcomes. The study's identification of peer teaching as more effective (mean = 59.16) compared to inquiry-based learning (mean = 44.74) suggests that social learning environments may interrupt this negative cycle by reducing the isolation often associated with mathematical struggle.

The flow from anxiety to reduced self-efficacy is particularly supported by Obialor et al.'s (2024) findings, where the relationship between students' attitude and academic achievement showed a moderate positive correlation ($r = 0.334$), while test anxiety demonstrated inverse relationships with performance outcomes. This inverse relationship substantiates the theoretical framework that anxiety directly undermines students' confidence in their mathematical abilities. Nwankwo et al. (2024) provided additional evidence for this progression by demonstrating that mathematics phobia significantly correlates with reduced willingness to pursue science subjects ($r = 0.398$, $p = 0.001$), indicating that anxiety effects extend beyond immediate performance to long-term academic and career trajectory decisions.

The progression from decreased interest to poor academic performance is evidenced by Akanbi et al.'s (2024) study, which found that students' negative perception of mathematics (mean = 3.13) significantly affected their learning behaviour, with teaching methods (mean = 2.85) and reinforcement strategies (mean = 3.09) playing crucial mediating roles. This suggests that the anxiety-to-avoidance pathway is not inevitable but can be interrupted through appropriate pedagogical interventions. The outcome of mathematics avoidance represents what Anazodo (2024) characterised as the most severe consequence, where students develop such strong negative associations that they actively avoid mathematical contexts, perpetuating a cycle of diminished exposure and further skill deterioration.

4.2 Mathematics Anxiety-Achievement Correlation (Figure 2)

One of the strongest findings in the literature reviewed is the moderate negative relationship between mathematics anxiety and academic achievement ($r = -0.52$). The relationship is very consistent in various populations using varying methodologies. Mathematics self-efficacy has a moderated correlation with performance ($r = 0.39$), although equating inferentially to its effect, as the longitudinal study by Okafor-Agbala and Okigbo (2021) of 5,096 SS2 students gives relatively resolute evidence that the opposite side of the correlation involves confidence processes.

The degree of correlation is quite different across geographical settings, which provides a valuable twist to the whole correlation. The correlation between rural and urban students exhibited significantly lower correlation coefficients ($r = -0.02$) between these groups than between the urban students ($r = 0.59$), and potentially, environmental factors either enhance or moderate the relationship between anxiety and attainment. This geographical difference is consistent with the results presented by Onyjekwe et al. (2025) showing that the school infrastructure (especially instructional materials: by 0.752 with increased eigenvalue of 0.679) and ICT facilities (by 0.575 with increased eigenvalue of 0.516) have a significant effect on academic performance. The urban correlations are even stronger, as they might represent the availability of a higher amount of resources, which offer students a wider range of coping mechanisms and sources of support.

The experimental observations of Onyeka et al. (2023) support the causal explanation of this agreement. Their experimental research showed a much greater result due to case variables where students who underwent inquiry-based instruction (mean = 21.26) had efficiency compared to scores with traditionally lecture-based gathering recipients (mean = 15.05), indicating the statistical oppressing interval (t -calculated = 7.66, p less than 0.05). This tension between anxiety-reducing methods of teaching and later improvements in performance is an experimental manipulation of this correlation that is likely to indicate true causal processes and is not a simple statistical relationship.

The long-term persistence of the said relationship is justified based on the findings of Obienyem (2024), who found regular patterns within the various fields of mathematics. Anxiety and phobia (mean = 2.62), poor methodology (mean = 3.07), and poor teacher preparation (mean = 3.14) were all rated by the students as major causes of poor performance in math. This consistency implies that the relationship between anxiety and achievement is not dependent because the phenomena themselves are dynamic features in particular situations.

4.3 Gender Differences in Mathematics Anxiety (Figure 3)

The gender difference depicted in Figure 3, whereby 75% of female students showed high mathematics anxiety and 55% of male students showed the same prejudice, portrays interactions among sociocultural expectations and unusual psychological reactions. This apparent difference, however, needs close interpretation considerations as there are some conflicting results within the literature. It makes the contradictory result of Nwankwo et al. (2024), who discovered that there was no statistically significant difference in the integration of the fear degree between the genders in mathematics (t -calculated = -0.212, $p = 0.563$), but there was a statistically significant difference in readiness to learn sciences (t -calculated = 3.72, $p = 0.049$).

Such a paradox indicates the potential of gender variance in mathematics anxiety to be more of an expression and behaviour demonstration than a representation of the level of fear. This difference between the feeling of anxiety and readiness to deal with mathematical material suggests that female students can have effective coping strategies, which provide them with the capability to pursue study relationships despite being more anxious. Experimental results presented by Onyeka et al. (2023) confirm this interpretation as male students obtained slightly higher mean gains (7.75) than female students (6.11) in the context of inquiry-based learning, but both groups significantly improved more than students taught using the traditional method.

The gender-specific correlation analysis by Obialor et al. (2024) gives some further insight into this pattern. The correlation between the attitude and achievement by female students ($r = 0.461$) was stronger than the correlation found between the two variables in male students ($r = 0.079$), which implies that the achievement might be more influenced by affective conditions in female students of mathematics. This hypersensitivity may be why the levels of reported anxiety are high, and the effectiveness of the supportive interventions is greater response. The way that women students reported a more consistent engagement pattern despite showing a greater level of anxiety conflicts with energy interpretations of gender variance. The career implications of these gender patterns are highlighted by the broader science engagement findings. Despite higher anxiety levels, female students' willingness to pursue science-related studies suggests that anxiety alone does not determine academic trajectory. This finding has important

implications for intervention design, suggesting that gender-specific approaches may need to address different aspects of the anxiety-achievement relationship for maximum effectiveness.

4.4 Contributing Factors Distribution (Figure 4)

The proportional distribution of contributing factors reveals teaching methods as the primary source of mathematics anxiety (36%), followed by environmental factors (26%), school resources (22%), and individual student factors (16%). This distribution challenges common assumptions that mathematics anxiety primarily stems from individual student characteristics, instead highlighting systemic and institutional contributors.

The predominance of teaching methods as contributing factors is extensively documented across multiple studies. Akanbi et al.'s (2024) comprehensive analysis found that students consistently rated teaching methods (mean = 2.85) and reinforcement strategies (mean = 3.09) as significant sources of difficulty. This finding is corroborated by Obienyem's (2024) identification of poor methodology (mean = 3.07) and lack of qualified teachers (mean = 3.14) as primary problems. The consistency of these findings across different populations and methodological approaches suggests that pedagogical factors represent the most modifiable source of mathematics anxiety.

The contribution of environmental factors to anxiety is reported to be 26 per cent, agreeing with rural-urban differences reported across the literature. Okafor-Agbala and Okigbo's (2021) demonstration of dramatically different self-efficacy correlations between rural ($r = 0.02$) and urban ($r = 0.59$) students illustrates how environmental context shapes the anxiety-achievement relationship. This environmental influence operates through multiple mechanisms, including peer support networks, family educational expectations, and community attitudes toward mathematical achievement.

School resources represent 22% of contributing factors, a proportion that reflects their crucial but often overlooked role in anxiety development. Onyejekwe et al.'s (2025) detailed analysis demonstrates that instructional materials predict 68% of performance variance ($R^2 = 0.679$), while ICT facilities explain 52% of variance ($R^2 = 0.516$). These substantial effect sizes suggest that resource availability directly influences student confidence and, consequently, anxiety levels. The finding that improved instructional materials lead to 75% advancement in student performance provides compelling evidence for resource-based interventions.

Individual student factors contribute only 16% to mathematics anxiety, a finding that contradicts popular beliefs about mathematical ability being primarily determined by inherent student characteristics. This relatively small contribution suggests that systemic interventions addressing teaching methods, environment, and resources may be more effective than individual-focused approaches. However, the persistence of individual differences, as demonstrated by varying response patterns to identical interventions, indicates that personalised approaches remain important for comprehensive anxiety reduction.

4.5 Effective Intervention Strategies (Figure 5)

The intervention strategies outlined in Figure 5 demonstrate success rates of 65-85% improvement in student performance and anxiety reduction, providing evidence for multiple effective approaches. The diversity of successful interventions suggests that mathematics anxiety can be addressed through various pathways, allowing for flexible implementation based on available resources and institutional contexts.

Inquiry-based learning emerges as a particularly robust intervention, with Akujieze's (2024) study demonstrating significant improvements in student engagement and performance. The finding that peer teaching showed even greater effectiveness (mean = 59.16 vs. 44.74) suggests that social learning components may be crucial for anxiety reduction. The higher variability in peer teaching outcomes indicates that this approach accommodates diverse learning styles more effectively, potentially reducing anxiety for students who struggle with traditional instructional formats.

Computer-assisted instruction represents one of the most dramatic intervention effects documented in the literature. Okafor and Samuel's (2024) experimental study found mean achievement gains of 17.06 for computer-assisted groups compared to 4.55 for traditional lecture groups, representing a 276% improvement. The statistical significance of this

difference ($F = 324.087, p < 0.001$) indicates robust effects that extend beyond chance variation. This technological approach may reduce anxiety by providing private, self-paced learning environments that eliminate public performance pressure.

Teacher professional development interventions show consistent positive effects across multiple studies. The emphasis on this approach reflects the finding that teaching methods contribute 36% of anxiety factors. Professional development programs addressing anxiety-sensitive pedagogy, as recommended by multiple studies, appear to create cascading positive effects throughout educational systems. The consistency of recommendations for teacher training across different research groups suggests a broad consensus about its importance.

Collaborative learning strategies demonstrate effectiveness through multiple mechanisms. The social support aspects of collaborative approaches may directly reduce anxiety by normalising mathematical struggle and providing peer assistance. Additionally, collaborative methods distribute cognitive load, potentially reducing the overwhelming feelings that contribute to mathematics anxiety. The success of these approaches aligns with the broader finding that social factors play crucial roles in anxiety development and reduction.

Self-efficacy building interventions target the psychological mechanisms underlying the anxiety-achievement relationship. The moderate correlations between self-efficacy and performance ($r = 0.39$) suggest that confidence-building approaches can produce meaningful improvements. These interventions often involve graduated exposure to mathematical challenges, success experience engineering, and cognitive restructuring techniques that directly address anxiety-producing thought patterns.

4.6 Multifactorial Influences on Mathematics Performance (Figure 6)

The complex web of interconnected factors depicted in Figure 6 reflects the sophisticated understanding that has emerged from comprehensive analyses of mathematics performance determinants. The identification of anxiety as the strongest negative predictor ($\beta = -0.67, p < 0.001$) provides quantitative confirmation of its central role while acknowledging the multiple pathways through which other factors operate.

The multifactorial model is supported by regression analyses demonstrating that single-factor explanations are insufficient for understanding mathematics performance variance. Onyejekwe et al.'s (2025) finding that instructional materials explain 68% of performance variance while ICT facilities explain 52% suggests overlapping influence pathways rather than independent effects. This overlap indicates that comprehensive interventions addressing multiple factors simultaneously may produce synergistic benefits exceeding the sum of individual interventions.

Self-efficacy emerges as a crucial mediating variable in the multifactorial model. The variation in self-efficacy correlations by geographical location (urban $r = 0.59$, rural $r = 0.02$) suggests that environmental factors moderate the relationship between confidence and performance. This moderation effect indicates that self-efficacy interventions may be more effective in some contexts than others, requiring contextual adaptation for maximum effectiveness.

Teaching quality represents another central node in the multifactorial web. The consistent identification of teaching methods as primary anxiety contributors across multiple studies suggests that teacher-related factors influence performance through multiple pathways. Direct instructional effects, classroom climate creation, and anxiety modelling by teachers all contribute to student outcomes through overlapping mechanisms.

School resources influence the multifactorial system through both direct and indirect pathways. Direct effects include providing tools and materials necessary for mathematical learning, while indirect effects operate through teacher confidence, student engagement, and institutional climate. The substantial effect sizes for resource-related variables suggest that material conditions create foundation effects that influence all other factors in the system.

Parental support and gender factors operate as background influences that shape the effectiveness of other variables. The gender differences in anxiety expression and the variation in family educational expectations create contextual conditions that influence how students respond to identical interventions. Understanding these background factors is crucial for designing effective, comprehensive intervention programs.

The interconnected nature of these factors suggests that successful mathematics anxiety reduction requires systemic approaches addressing multiple influence pathways simultaneously. Single-intervention approaches, while potentially beneficial, may be limited by the persistence of other contributing factors. The quantitative evidence

supports comprehensive intervention models that address teaching methods, institutional resources, individual psychological factors, and environmental contexts in a coordinated fashion.

5. Conclusion

This systematic review of literature from Anambra State (2015-2025) establishes mathematics anxiety as a significant barrier to student achievement and interest in mathematics among senior secondary school students. The evidence reveals a consistent moderate negative correlation ($r = -0.52$) between mathematics anxiety and academic performance, with teaching methods contributing 36% of anxiety factors, making them the most significant modifiable predictor.

The multifactorial nature of mathematics anxiety requires comprehensive intervention approaches rather than single-factor solutions. Computer-assisted instruction demonstrated the most dramatic effects (276% improvement), while inquiry-based learning and peer teaching methods showed substantial benefits (65-85% success rates). Gender differences in anxiety expression, though present, do not translate to differential learning capacity when appropriate pedagogical support is provided.

Rural-urban disparities in anxiety-achievement correlations ($r = 0.02$ vs. $r = 0.59$) highlight the critical role of environmental and resource factors. The finding that instructional materials and ICT facilities predict 68% and 52% of performance variance, respectively, underscores the importance of adequate educational infrastructure.

The evidence strongly supports systematic interventions targeting teacher professional development, resource enhancement, and anxiety-sensitive pedagogical approaches. These findings have immediate implications for educational policy in Anambra State, suggesting that mathematics anxiety can be effectively addressed through coordinated efforts involving improved teaching methods, enhanced resources, and supportive learning environments that accommodate diverse student needs and learning styles.

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