



MATHEMATICS ANXIETY AS A PREDICTOR OF SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS: THE MODERATING ROLE OF GENDER

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Abstract

This study set out to examine how well Mathematics anxiety predicts the academic achievement of senior secondary school students in Mathematics, and whether gender moderates that prediction, with the Awka Education Zone of Anambra State, Nigeria, as its location. A correlational survey design of the predictive type was adopted. Three research questions and two null hypotheses tested at the 0.05 level guided the work. The population comprised 4,674 Senior Secondary Two students in 64 public schools, from which a multi-stage sampling procedure selected 350 students, 145 male and 205 female. A 20-item Mathematics Anxiety Rating Scale, together with students' termly achievement records in Mathematics, provided the data, and the scale yielded a Cronbach's alpha of .86. Simple linear regression, hierarchical regression, and subgroup regression were used for the analysis. The results showed that anxiety predicted achievement negatively and significantly, accounting for about a quarter of the variance in scores. Adding the anxiety-by-gender term brought no significant change, so gender did not moderate the relationship, and separate regressions for boys and girls confirmed a near-identical pattern. The study concluded that anxiety lowers achievement to much the same degree across gender, and recommended anxiety-easing teaching that reaches every learner.



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Keywords: Mathematics Anxiety, Academic Achievement, Gender, Moderation, Senior Secondary, Students

1.1 Introduction

Few subjects carry the weight that Mathematics does in the school system. It underpins the sciences, holds up trade and finance, and sharpens the sort of reasoning that learners keep drawing on long after they leave the classroom. Abakpa, Anyagh and Tembe (2020) noted that the subject

has held its place across cultures and economic systems precisely because its usefulness does not date, while Agah (2020) tied a nation's scientific and technological progress to how well its citizens handle number and pattern. In Nigeria, where Mathematics is compulsory through basic and senior secondary schooling and serves as a gateway to most higher courses, a fair measure of success in it is expected of every candidate.

That expectation makes achievement the outcome teachers and parents watch most closely. Academic achievement refers to what a learner has absorbed and can demonstrate after instruction, and it is usually assessed through test scores, class exercises, and examination grades. Hattie (2023) framed it as the measurable level of knowledge and skill a student attains; for this study, it simply means the marks students earn in Mathematics. The difficulty is that the marks in Awka Education Zone have been slipping. Records from the West African Examinations Council put credit passes in the zone at 72.49% in 2023, 69.18% in 2024, and 66.59% in 2025, a trend that has persisted even as the state recruited trained teachers and improved school facilities.

Explanations that rest on ability or teaching alone sit awkwardly against this record. The examiners' reports over the same years keep naming the same faults, among them misread questions and shaky work with graphs, which look less like plain ignorance than like the marks of a learner who cannot think clearly under pressure. This turns attention to how students feel while they work, and one feeling has drawn more study than any other in this regard, namely Mathematics anxiety.

Mathematics anxiety is the unease, tension and dread that come over some learners at the prospect of handling numbers or sitting a Mathematics test. Ashcraft and Krause (2020) traced its bite to working memory, arguing that worry crowds out the mental space a student needs to hold figures and follow steps, so performance suffers even when the knowledge is present. Closer to home, Okoye and Iheoma (2020) recorded this test-time anxiety among Anambra State candidates, and Atoyebi, Atoyebi and Ajao (2023) treated it as a concern that reaches learners across ages and places rather than a local peculiarity. Reviewing a decade of Nigerian work, Chukwunonso (2025) reported that anxiety weighs on Mathematics performance often enough to warrant steady attention.

The cost of this anxiety does not end at the test. Learners who dread the subject tend to sidestep practice, skip the harder tasks and, over time, back away from Mathematics-heavy paths altogether. Daker, Gattas, Sokolowski, Green and Lyons (2021) followed students into university and found that early anxiety forecast later avoidance and weaker results independent of ability, and Rozgonjuk, Kraav, Mikkor, Orav-Puurand and Täht (2020) linked the same fear to shallow study habits. Chan and Roslinda (2021) put the pattern plainly when they reported that achievement tends to fall as anxiety climbs. If the fear accompanies lower marks, then learning how closely the two are linked in a given setting is a first step toward acting on it.

A further question is whether the relationship looks the same for boys and girls. Gender has long featured in Mathematics research, though the findings refuse to settle into a clear line. Ghasemi and Burley (2019) reported that girls sometimes outdo boys. In contrast, Anokye-Poku

and Ampadu (2020) in Ghana and Okafor-Agbala, Okonkwo and Obikezie (2022) in Anambra State found no gender gap in achievement. On anxiety in particular, some studies place girls higher. In contrast, others reverse or erase the difference, which leaves open the question that matters most for teaching, that is whether gender alters the force with which anxiety bears on achievement rather than merely the level of anxiety reported.

Much of the local evidence stops short of that question. Studies tend to measure anxiety and achievement, note a correlation, and treat any gender difference as a matter of who feels more anxious, without testing whether gender shifts the **strength** of the prediction itself. Fewer still have done so among senior secondary students in Awka Education Zone, where the achievement slide gives the matter real urgency. The present study addresses this gap by asking not only how far anxiety predicts achievement, but also whether that prediction holds with equal force for male and female students.

1.2 Statement of the Problem

Mathematics is compulsory in Nigerian secondary schools and a requirement for entry into most tertiary programmes, so students are expected to reach at least a credit pass in it. The evidence from Awka Education Zone falls short of that expectation. Credit passes in the zone dropped from 72.49% in 2023 to 66.59% in 2025, which means that roughly a third of candidates failed to clear the benchmark in the most recent year. The decline has persisted despite fresh teacher recruitment, revised syllabuses and the spread of digital teaching tools, so the standard explanations no longer feel adequate on their own.

The examiners keep returning to the same weaknesses, and while these read as gaps in knowledge, they may well be symptoms of the anxiety many learners carry into the subject. A student gripped by Mathematics anxiety can lose access, under test conditions, to methods that were clear only the day before. Yet the research guiding a response is uneven. Reports on the size and even the direction of the anxiety-achievement link disagree, and studies seldom ask whether the link is the same for boys and girls, which matters because an intervention aimed at the wrong group wastes effort. Much of this work has also been carried out well away from Awka Education Zone, or has folded anxiety in with other variables without isolating its predictive weight. It was against this background that the study examined Mathematics anxiety as a predictor of senior secondary school students' academic achievement in Mathematics and tested whether gender moderates that prediction in Awka Education Zone of Anambra State.

1.3 Research Questions

The following questions guided the study:

1. What is the predictive value of Mathematics anxiety on senior secondary school students' academic achievement in Mathematics in Awka Education Zone?
2. Does gender moderate the prediction of students' academic achievement in Mathematics by their Mathematics anxiety?
3. Which gender shows the stronger relationship between Mathematics anxiety and academic achievement in Mathematics?

1.4 Hypotheses

Two null hypotheses were tested at the 0.05 level of significance:

H₀₁: Mathematics anxiety does not significantly predict senior secondary school students' academic achievement in Mathematics in Awka Education Zone.

H₀₂: Gender does not significantly moderate the prediction of students' academic achievement in Mathematics by their Mathematics anxiety.

The third question was addressed descriptively, using separate regressions for male and female students, consistent with the moderation test in H₀₂.

2. Review of Related Literature

The study drew its main frame from the Control-Value Theory of achievement emotions, which Pekrun (2006) set out to explain how feelings arise during academic work and then feed back into performance. The theory turns on two judgements a learner makes about a task: how much control they feel they have over succeeding at it, and how much they value it. Anxiety, in this account, tends to rise when a student cares about doing well in Mathematics yet doubts the capacity to manage it, and because anxiety is an activating but unpleasant emotion, it can quietly drain the very performance the learner is anxious to protect. This makes the theory a fitting lens for the question at hand.

A second and complementary account looks inside the moment of testing. Ashcraft and Krause (2020) argued that anxiety consumes part of working memory, the short-term store a student relies on to hold numbers and track steps, leaving less room for the sums themselves. Carey, Hill, Devine and Szűcs (2019) examined the direction of the link and concluded that weak early performance and rising anxiety most likely feed into each other rather than running in one direction. Ma and Sun (2025) recently reported that working memory shapes how strongly anxiety bears on achievement, which fits the idea of a fear that does its harm by occupying mental resources.

Empirical work has largely borne out these accounts. In a broad meta-analysis, Barroso, Ganley, McGraw, Geer, Hart, and Daucourt (2021) found a small-to-moderate negative association between Mathematics anxiety and achievement, with the strength of the association shifting across grade levels. Du, Qin, Wang and Xin (2021) tracked anxiety, interest and self-efficacy over time and showed them pulling on one another, so that early fear can set a downward course. Gabriel, Buckley and Barthakur (2020) reported that anxious learners regulate their own study less well, which surfaces as weaker mathematical literacy. Working in India and China, Nandhini and Subramanian (2021) and Gao, Wang, Shen and Sun (2020) reached the same broad conclusion: higher anxiety is associated with lower achievement.

Nigerian studies echo much of this. Ihendinihu (2022) and Njoku and Okigbo (2021) each found that anxiety significantly predicted secondary students' Mathematics results, and Gopal (2025) reported the same for Nepalese learners. The agreement is not complete, though. Adeniran, Fajobi and Osiesi (2026) reported only a weak positive association between anxiety and achievement in Kwara State, and Molla, Rashid and Sultana (2026) found a positive correlation in

an Indian sample, both of which run counter to the usual negative pattern. Clashes of this kind tend to trace back to the scales chosen, the make-up of the samples and the way achievement was captured, which is part of why fresh evidence from a defined setting still earns its place.

The gender picture is the least tidy of all. Else-Quest, Hyde and Linn (2020) concluded from cross-national data that differences in Mathematics-related emotion owe more to culture and classroom practice than to anything fixed about boys and girls, regarding achievement; Ching and Kung (2018) found girls in Taiwan performing on par with boys in Mathematics, and Oliweh and Oyem (2021), together with Ahmed and colleagues (2021), reported no significant gender gap in Nigerian samples. On anxiety levels, the readings scatter further. Amulya, Das, Bariha and Behera (2026) found higher anxiety among boys in an Indian district, whereas Ambilong (2026) and Dungdung and Bakira (2021) placed girls higher. Kalwani and Tripathi (2025) drew a useful distinction, reporting gender differences in how much anxiety students felt but not in the direction of its tie with achievement.

That last distinction marks the space this study occupies. Knowing that one gender reports more anxiety is not the same as knowing that anxiety costs one gender more in achievement, and it is the second claim that should decide whom an intervention targets. Ebong, Ihendinihu and Attai (2025) began to address this in Akwa Ibom State and found that gender did not moderate the anxiety-achievement link. Whether the same holds among senior secondary students in Awka Education Zone, where results have been falling, is an open and practical question, and it is the one the present study answers.

3. Methods

The study used a predictive correlational survey design. This design suits work that seeks the degree of relationship between variables without altering any of them (Creswell & Creswell, 2018; Fraenkel, Wallen & Hyun, 2019). It fitted the present aim, which was to learn how far Mathematics anxiety could predict achievement, and whether gender changed that prediction, rather than to establish cause. The work was carried out in the Awka Education Zone of Anambra State, the largest of the state's six education zones. The zone houses 64 public senior secondary schools under the Post Primary Schools Service Commission and spans the Awka North, Awka South, Anaocha, Dunukofia, and Njikoka local government areas. It was chosen because of the recent downward drift in its Mathematics results at the Senior Secondary Certificate Examination.

The population comprised 4,674 Senior Secondary Two students offering Mathematics in the 64 public schools during the 2025/2026 session. Students at this level were judged suitable because they had covered a good part of the senior curriculum yet had not slipped into intensive examination coaching, so their responses on anxiety were likely to be candid, and their achievement could still be read from school records. A multi-stage procedure produced the sample. Purposive sampling first selected the 49 co-educational schools from the 64, as the study required both boys and girls at each school. Simple random sampling by balloting was then used to draw three of the five local government areas, after which four schools were selected from each, giving 12 schools. Proportionate stratified sampling next drew half of the male and female students from those schools, yielding 367 students, a share that falls within the range Nworgu (2015) regards as

adequate for educational research. After the scale was administered and screened, complete and usable data were obtained from 350 students, 145 male and 205 female, and these formed the basis for analysis.

Two sources of data were used. The first was the Mathematics Anxiety Rating Scale, adapted from the scale originally built by Richardson and Suinn (1972). It carried 20 items, answered on a four-point scale ranging from Strongly Agree to Strongly Disagree, scored from 4 to 1 for positively worded items and reversed for negatively worded items. In adapting it, the original subscales were consolidated into a single scale, and an item on gender was added to align with the study's focus. The second source was a proforma that recorded each student's cumulative Mathematics results over two terms of the session, serving as the measure of achievement.

Face and content validity were established by three experts, one from science education, one from educational psychology, and one from measurement and evaluation, who checked the items for clarity and for fit with the study's purpose. Their suggestions, which included rewording and personalising some items, were worked into the final copies. Reliability was then tested on 30 Senior Secondary Two students drawn from two schools in Enugu State, outside the study area. Using Cronbach's alpha, the scale returned a value of .86, which Nworgu (2015) treats as high, so the instrument was judged dependable.

The researcher gathered the data with the help of six Mathematics teachers from the sampled schools, who served as research assistants. After a letter of introduction and permission from the school heads were secured, the scale was distributed and retrieved on the same day through a direct-delivery approach, which kept the return rate high. Each student was assigned a code so that the anxiety scores could later be matched to the achievement records. Of the 367 copies distributed, 350 were properly completed and used, a return of about 95%. The first question and its hypothesis were tested with simple linear regression. The second question, which included gender, was analysed using hierarchical regression, entering the anxiety-by-gender interaction at the second step to assess whether it added to the variance explained. The third question was answered descriptively by running separate regressions of anxiety on achievement for male and female students. Values of R were read as low below .30, moderate from .30 to .80, and high above .80, and each null hypothesis was rejected where the p-value fell below .05.

4. Results

The first question asked how far Mathematics anxiety predicted achievement. Table 1 sets out the simple regression result.

Table 1: *Simple Linear Regression of Mathematics Anxiety on Academic Achievement in Mathematics*

Predictor	R	R ²	B	β	t	F (1, 348)	p
Mathematics anxiety	.501	.251	-9.845	-.501	-10.80	116.676	.000

Note. Dependent variable: academic achievement in Mathematics. Std. error of the estimate = 12.056.

Anxiety showed a moderate negative link with achievement and explained 25.1% of its variance, so that each one-point rise on the anxiety scale went with a drop of about 9.85 marks. The model was significant, which meant the first null hypothesis was rejected. In this zone, then, anxiety stands as a real and downward predictor of how students fare in Mathematics, though it leaves most of the variance to other causes.

The second question asked whether gender changed that prediction. Table 2 reports the hierarchical model.

Table 2: *Hierarchical Regression Predicting Achievement from Mathematics Anxiety and the Anxiety $\times$ Gender Interaction*

Step	Predictor(s)	R ²	R ² change	F change	df	p
1	Mathematics anxiety	.251	.251	116.676	1, 348	.000
2	Anxiety $\times$ Gender	.256	.005	2.265	1, 347	.133

Note. Interaction coefficient at Step 2: $\beta = .072$, $t = 1.505$, $p = .133$. Dependent variable: academic achievement.

Adding the interaction term lifted the explained variance by only half a percent, and that change fell short of significance. The interaction coefficient told the same story, being small and non-significant. The second null hypothesis was therefore retained. Put simply, anxiety pressed on achievement to much the same degree whether the student was a boy or a girl, so gender did not moderate the link.

The third question looked at which gender showed the stronger tie. Table 3 gives the two subgroup regressions.

Table 3: *Subgroup Regressions of Mathematics Anxiety on Academic Achievement by Gender*

Gender	n	R	R ²	B	β	F	p
Female	205	.500	.250	-9.915	-.500	67.671	.000
Male	145	.510	.260	-9.894	-.510	50.332	.000

Note. Degrees of freedom: females (1, 203), males (1, 143). Dependent variable: academic achievement.

Both groups showed a negative and significant link within themselves. The relationship was a shade stronger among boys, whose anxiety explained 26.0% of the variance against 25.0% for girls, and whose standardised weight was marginally larger. The unstandardised weights, though, were almost the same for the two groups, which means a one-point rise in anxiety cost boys and girls a near-equal drop in marks. Read against the non-significant interaction in Table 2, this small gap should be taken as a descriptive detail rather than a real difference in how anxiety works across gender.

5. Discussion of Findings

The finding that Mathematics anxiety predicted achievement negatively lines up with a good deal of earlier work. Within Nigeria, Ihendinihu (2022) and Njoku and Okigbo (2021) each reported that anxiety significantly predicted secondary students' results, and the same pattern surfaced in the studies of Chandel (2024), Gao, Wang, Shen and Sun (2020), Gopal (2025), and Nandhini and Subramanian (2021), as well as in the meta-analysis of Barroso, Ganley, McGraw, Geer, Hart and Daucourt (2021). The likely reason is the one Ashcraft and Krause (2020) described: anxious learners spend part of their working memory on the fear of failing, leaving less for the actual computation, while their tendency to avoid practice thins their skills over time. The agreement is not universal, and the exceptions are worth naming. Adeniran, Fajobi and Osiesi (2026) found a weak positive tie in Kwara State, and Molla, Rashid and Sultana (2026) reported a positive correlation in India, results that most likely reflect differences in the scales, samples and scoring used rather than a genuine reversal of the effect.

On the question of gender, the study found no moderation, which means anxiety bore on achievement in much the same way for boys and girls. This agrees with Ebong, Ihendinihu, and Attai (2025), who likewise found that gender did not moderate the anxiety-achievement link, and it aligns with Kalwani and Tripathi (2025), who reported gender differences in the level of anxiety felt but not in the direction of its relationship with achievement. The result also chimes with the broader Nigerian finding of no gender gap in Mathematics achievement, as recorded by Anokye-Poku and Ampadu (2020) and by Oliweh and Oyem (2021). It runs, however, against Ambilong (2026), who found girls more anxious and boys higher-performing, and against Dungdung and Bakira (2021), who read less anxiety and stronger results among girls. Amulya, Das, Bariha, and Behera (2026) muddy the waters further by placing boys at a higher level of anxiety. Such disagreement is common in gender research, where the reading turns heavily on setting and method, and the present result suggests that, in this zone, anxiety does its damage regardless of sex.

The subgroup comparison fits that reading. Anxiety's hold was a fraction stronger among boys, both in the share of variance explained and in the standardised weight, yet the gap was slight and, given the non-significant interaction, cannot be treated as a real difference. What stands out instead is how alike the two patterns were, since a one-point rise in anxiety carried almost the same cost in marks for either group. Taken together, the findings say that anxiety is a shared burden in this setting, not one that falls on one gender more than the other, and any response to it should be built with that in mind.

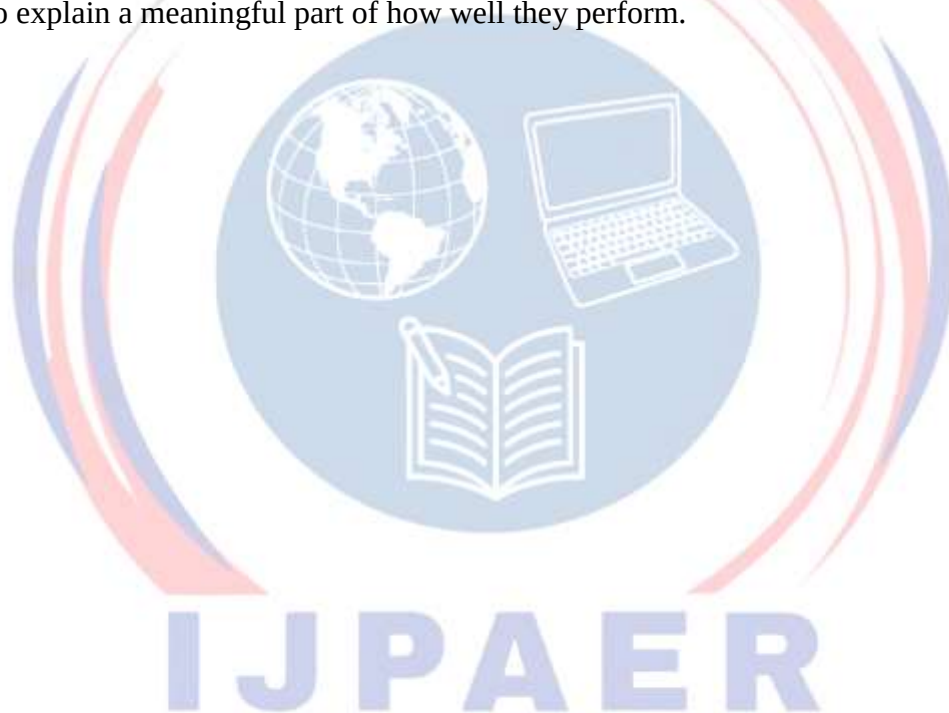
6. Conclusion

The study examined how far Mathematics anxiety predicts senior secondary students' achievement in Mathematics in the Awka Education Zone, and whether gender moderates that prediction. The answer is that anxiety is a real and downward predictor of achievement, accounting for about a quarter of the differences in students' scores, and that its pull is felt to much the same degree by boys and girls. Gender, in other words, does not decide who suffers most from the fear. Because the burden is shared, efforts to improve Mathematics results in the zone will be more

effective if they treat anxiety as a common classroom problem rather than the concern of one group of learners.

7. Recommendations

In light of these findings, the study offers a few recommendations. Mathematics teachers should lean on methods that ease tension in the classroom, such as cooperative tasks, worked examples drawn from everyday life and a generous use of teaching aids, so that learners meet the subject with less dread. Since the effect of anxiety did not differ by gender, any programme built to reduce it, whether through counselling, spaced practice or a calmer approach to testing, should reach boys and girls alike rather than target one group. School counsellors and administrators should watch for signs of anxiety early and give students simple ways to manage it. Routine monitoring of Mathematics programmes should include a brief check on students' anxiety, since it appears to explain a meaningful part of how well they perform.



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