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Students' Anxiety and Mathematics Achievement in Senior Secondary School II in Abak Local Government Area, Akwa Ibom State

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ABSTRACT

This study investigates the influence of students' anxiety and mathematics achievement among Senior Secondary School II students in Akwa Ibom State, Nigeria. The study aims to uncover the influence of this psychological factor on students' academic performance in mathematics, and a predictive research design was employed. In this study, gender was incorporated as a moderating variable. Data was collected from 180 randomly selected students across six public secondary schools within the zone. The instruments for data collection were the Mathematics Achievement Test (MAT) and structured questionnaires to measure anxiety. The reliability of MAT was established using the Kuder-Richardson formula 20 (K-R20), and a coefficient of 0.798 was obtained. Cronbach's Alpha (α) was used for the calculation of the reliability indices of Mathematics anxiety as 0.893. Data were analysed using Pearson product-moment correlation, multiple regression, and moderated regression. Findings show that affective factors, such as mathematics anxiety, negatively impact students' performance, with high levels of anxiety correlating with lower achievement. Gender differences were explored, and results show that gender does not significantly moderate the prediction of mathematics achievement with anxiety. The research recommends educational strategies that enhance students' attitudes towards mathematics. Such strategies could help mitigate anxiety and improve overall performance.

Keywords: *Anxiety, Mathematics Achievement, Gender and Students*

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INTRODUCTION

In Nigeria, Mathematics is a compulsory subject in primary and secondary schools. It is also expected that a student should obtain at least a credit pass in WAEC or NECO as a basic requirement for admission in the University (NgutorTembe *et. al.* 2020). Mathematics is a subject that affects every aspect of human life at different levels. Several factors, such as attitude of students and teachers, study habits, teachers' qualifications, teaching methods, school environment, government policy, school location, and family types have been identified in several studies as factors influencing students' academic achievement (Asikhia, 2010; Akomolufe and Olorumfemi-Olabisi, 2001).

This is worrisome and calls for relentless efforts in research so that the achievement of students in Mathematics is improved. As a result, the researcher hypothesised that mathematical anxiety towards mathematics may be contributing to the issue of low academic performance. Academic achievement is the extent to which a learner or institution has achieved either short-term or long-term instructional/educational objectives. It is the parameter for verifying the extent of learning that has occurred or the level of proficiency an individual attained in both internal and external examinations. The academic achievement of students has been measured using achievement tests or other forms of standardized examinations and continuous assessment tools (Ihendinihu 2022).

According to the American Psychological Association, anxiety is defined as an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure (Ihendinihu, 2022). Essuman *et al.* (2021) define Mathematics anxiety as tension and anxiety that interferes with the manipulation of numbers and the solution of mathematical problems in a wide variety of everyday life and academic situations.

Various researchers have also studied the impact of students' affective factors and mathematics achievement; Mweni *et al.* (2023) sought to establish the relationship between student anxiety and achievement in mathematics. A descriptive Survey research design on a sample size of 250 students used a mathematics anxiety rating scale and a mathematics achievement test to collect quantitative data. The computational formula of Pearson`s product-moment correlation coefficient (rxy) determined the null hypothesis, "there is no statistically significant relationship between student anxiety and achievement in mathematics". The study found that there was a statistically significant positive correlation coefficient of rxy= 0.38 between student anxiety and achievement in mathematics. This implies that student anxiety is indirectly proportional to achievement

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in mathematics. However, analysis based on gender differences contradicts the stereotype that females are always of higher anxiety levels towards mathematics than males.

Ihendinihu (2022) examined the extent to which anxiety, attitude and emotional intelligence predict mathematics achievement among secondary school students in Imo State. Correlational and predictive research designs were adopted. A sample of 391 senior secondary school two students (SSS2) was selected from a population of 1,538 using purposive and simple random sampling techniques. Four instruments used for data collection are: Mathematics Anxiety Scale (MAS), Mathematics Attitude Scale (MATS), Emotional Intelligence Scale (EIS) and Mathematics Achievement Test (MAT). The instruments were validated by three experts. A reliability coefficient obtained for anxiety, attitude and emotional intelligence scales is .78, .79, and .74, respectively, using Cronbach's Alpha. The reliability of the mathematics achievement test was determined using the Kuder Richardson formula 20 and a coefficient of .88 was obtained. The data analyses using mean and standard deviation as well as multiple linear regression, at the .05 level of significance, indicated that anxiety, attitude and emotional intelligence significantly predict mathematics achievement.

Njoku and Okigbo (2021) examined how mathematics anxiety and emotional intelligence predicted secondary school students' academic achievement in Mathematics CCSSE. The purpose of this study was to determine how mathematics anxiety and emotional intelligence predicted secondary school students' academic achievement in Mathematics CSSE. The study was guided by five research questions and three hypotheses tested at a 0.05 alpha level of significance. The study adopted a correlation survey design. The population of the study comprised 33,073 SS3 students (16726 males and 16348 females) in 297 public senior secondary schools in Imo State, with a sample of 1654 SS3 students in public secondary schools drawn using a multi-state sampling technique. The instruments for data collection were the Mathematics Anxiety Scale (MAS) and the Emotional Intelligence Questionnaire (EIQ). The data collected were analyzed using mean and regression analysis. The findings of this study were as follows: Mathematics anxiety and emotional intelligence predict secondary school students' achievement in Mathematics CSSE.

The data analysis and suggestions will guide the education policy makers and mathematics teachers to review (if necessary) the secondary school Mathematics education approaches. The study will also provide useful data for future researchers in the same area. The findings of this study will help teachers become aware or more aware of some affective factors and its implication on students toward academic achievement.

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The finding will also help teachers listen to students more and skillfully manage their thoughts.

Scope of the Study

This study is limited to the students' affective factors such as Anxiety and mathematics achievement in all the secondary schools in Abak Local Government Area, Akwa Ibom State. The study was restricted to male and female senior secondary two (SS 2) students in public schools.

Purpose of the Study

The purpose of this study is to:

1. Find out the relationship between anxiety and students' achievement in mathematics
2. Determine the percentage of achievement in mathematics and the model or equation of the relationship between Mathematics achievement can be explained by Anxiety
3. Determine the contribution of anxiety in predicting achievement in Mathematics
4. To determine the moderating influence of gender in predicting students' achievement in mathematics with Anxiety

Hypotheses

The following null hypotheses are stated to guide the study and will be tested at 0.05 level of significance.

$H_0$1: There is no significant relationship between student's Anxiety and Mathematics achievement.

$H_0$2: Anxiety do not significantly predict achievement in mathematics among secondary school students.

$H_0$3: Anxiety does not significantly predict students' achievement in Mathematics.

$H_0$4: Gender does not significantly moderate prediction of Mathematics achievement with Anxiety.

METHOD

Design of the Study

The study adopted correlational and predictive research designs because it sought to establish the strength of a relationship (correlation) between the variables and the extent

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to which the independent variables predict the dependent variable. Hence, mathematics achievement will be predicted using anxiety as well as gender.

Area of Study

The study area is Akwa Ibom State, Nigeria. Akwa Ibom State has thirty one (31) Local Government Areas and is located at the southern part of the country basically in the south-south. Akwa Ibom State is located between Longitudes 7^0 15^1E and 8^0 30^1E and Latitude 4^0 30^1N and 5^0 30^1N with the total area of about 50km^2 (Ebong *et al.* 2014, 2023). Abak Local Government Area (LGA) is the study location in Akwa Ibom State as shown in Figure 1. Abak town is located about 18km from Uyo, the state capital. It has a landmass of 304 square kilometres.

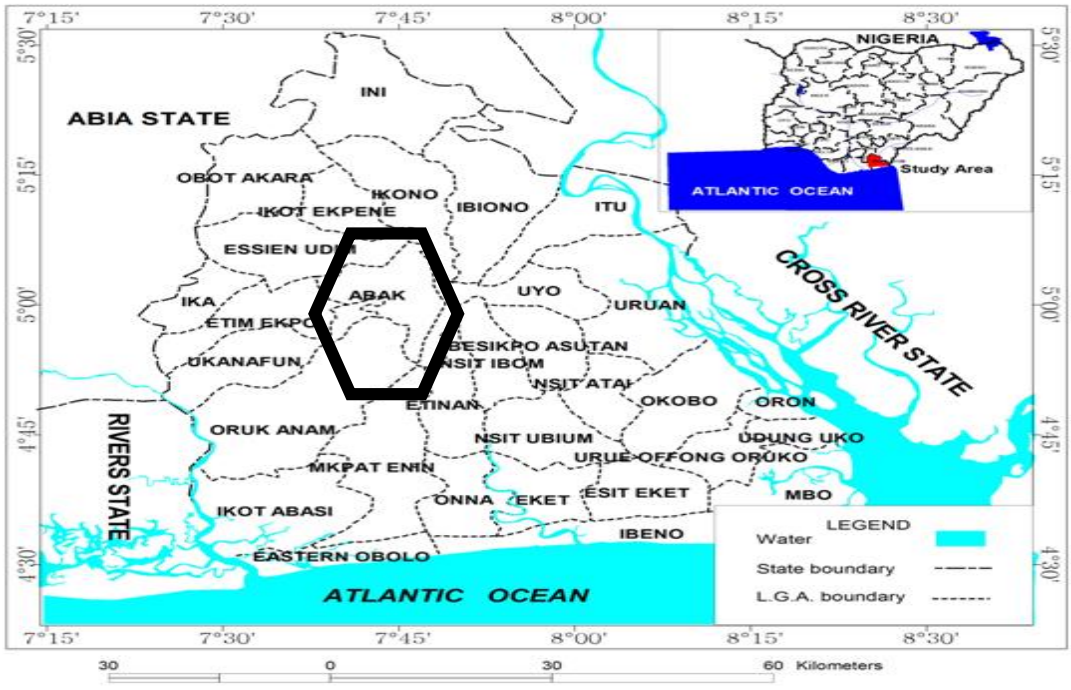

Figure 1: Map of Akwa Ibom State indicating the study location (Ebong, Ekanem and George, 2023; Ebong, S. T. *et al.*.,2023).

Population of the Study/ Sample and Sampling Techniques

The population for this study consists of 1,110 Senior Secondary Two (SS2) mathematics students in ten secondary schools within Abak Local Government Area of Akwa Ibom

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State. Abak has ten (10) public secondary schools. A sample of 180 SS2 mathematics students was drawn from six (6) public secondary schools in Abak. To reflect the true nature of Abak indigenes, the researcher selected six (6) secondary schools from rural communities or clans, excluding the urban region. This reduced the influx of visitors who are not indigenes of Abak due to their exposure (Attai Ekaette Samuel *et al.*, 2015). From these six selected secondary schools, the researcher used simple random sampling to select 180 students. Each school provided 30 students, with 15 boys and 15 girls from each.

Instruments for Data Collection

A structured anxiety scale was carefully constructed for data collection on students' anxiety in Mathematics. The students were expected to tick (√) the extent to which they agree or disagree with the items on the scale. The scale was constructed in 4-point Likert scale with 15 items as Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, Strongly Disagree (SD) = 1.

Mathematics achievement test (MAT)

The achievement test was constructed by the researcher, which consists of a 30-item multiple-choice test from the SS2 Mathematics curriculum. The responses on the MAT were marked and scored accordingly. For consistency and objectivity in scoring the students' test items, a marking guide was developed by the researcher. The table of specifications that guided the 30-item multiple-choice questions is shown in Table 1, while Table 2 indicates the computation and analysis of the blueprint.

Table 1: Table of Specification for Mathematics Achievement Test (MAT)

Units/ Topics	**Remembering 26%**	**Understanding 24%**	**Applying 32%**	**Analyzing 18%**	**Total (Number of items)**
Simultaneous & Quadratic Equation 20%	2	2	3	1	8
Statistics (MCT) 28%	2	2	2	1	7
Trigonometry 21%	2	1	2	1	6
Probability 11%	1	1	2	1	5
Logarithms & Circle Geometry 20%	1	1	1	1	4
Total 100%	8	7	10	5	**30**

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Table 2: Table of Specification for Mathematics Achievement Test (MAT) Computation and Analysis

Units/ Topics	**Remembering 26%**	**Understanding 24%**	**Applying 32%**	**Analyzing 18%**	**Total (Number of items)**
Simultaneous & Quadratic Equation 20%	$\frac{26\% \times 8}{100} = 2.08 \approx 2$	$\frac{24\% \times 8}{100} = 1.92 \approx 2$	$\frac{32\% \times 8}{100} = 2.5 \approx 3$	$\frac{18\% \times 8}{100} = 1.44 \approx 1$	8
Statistics (MCT) 28%	$\frac{26\% \times 7}{100} = 1.82 \approx 2$	$\frac{24\% \times 7}{100} = 1.68 \approx 2$	$\frac{32\% \times 7}{100} = 2.24 \approx 2$	$\frac{18\% \times 7}{100} = 1.26 \approx 1$	7
Trigonometry 21%	$\frac{26\% \times 6}{100} = 1.56 \approx 2$	$\frac{24\% \times 6}{100} = 1.44 \approx 1$	$\frac{32\% \times 6}{100} = 1.92 \approx 2$	$\frac{18\% \times 6}{100} = 0.75 \approx 1$	6
Probability 11%	$\frac{26\% \times 5}{100} = 1.3 \approx 1$	$\frac{24\% \times 5}{100} = 1.2 \approx 1$	$\frac{32\% \times 5}{100} = 1.6 \approx 2$	$\frac{18\% \times 5}{100} = 0.9 \approx 1$	5
Logarithms & Circle Geometry 20%	$\frac{26\% \times 4}{100} = 1.04 \approx 1$	$\frac{24\% \times 4}{100} = 0.96 \approx 1$	$\frac{32\% \times 4}{100} = 1.28 \approx 1$	$\frac{18\% \times 4}{100} = 0.75 \approx 1$	4
Total 100%	$\frac{26\% \times 30}{100} = 7.8 \approx 8$	$\frac{24\% \times 30}{100} = 7.2 \approx 7$	$\frac{32\% \times 30}{100} = 9.6 \approx 10$	$\frac{18\% \times 30}{100} = 5.4 \approx 5$	**30**

Reliability of the Research Instrument

The reliability of the Mathematics Achievement Test (MAT) was determined by using the Kuder-Richardson formula 20 (K-R20). This is because the instrument was dichotomously scored. The reliability coefficient obtained was 0.798, which is 79.82% approximation. Cronbach's Alpha (α) was used for the calculation of the reliability indices of the Mathematics Anxiety Scale (MAS). The Reliability indices were 0.892 (89.2%). This was considered high enough for good internal consistency.

Method of Data Analysis

The statistical tools used in the data analysis are indicated by the hypotheses of the study. The data were analyzed using Pearson's Correlation Coefficient to answer the research questions. The hypotheses were tested using the correlation analysis at a 0.05 level of significance, as well as multiple regression analyses and moderated regression. Meanwhile, in testing hypotheses, the hypothesis of no significant difference was rejected; the p-value or significance of r is less than the alpha value of 0.05. It was not rejected, where the p-value is equal or greater than the alpha value of 0.05. For moderated regression, the decision is based on f-change statistics.

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RESULTS AND DISCUSION

The results of the descriptive and inferential analyses were presented in Tables as follows.

Table 3: Relationship between anxiety and achievement in Mathematics

Variables	N	R	R^2
Anxiety SMA	180	-.894	.799

SMA is Students' Mathematics Achievement

Table 3 shows that the correlation coefficient of anxiety and mathematics achievement is -.894. Hence, the relationship between Mathematics anxiety and achievement in Mathematics is very high and negative. This shows that as anxiety increases, Mathematics achievement decreases. The R^2 of .799 shows that 79.9% variance in mathematics achievement can be explained or accounted for by mathematics anxiety. It will be observed that this percentage is very high. Hence, anxiety plays a prominent role in students' understanding of mathematics.

Table 4: Significance of the relationship between anxiety and achievement in Mathematics

Variables	N	R	Sig	Decision
Anxiety SMA	180	-.894	.000	Reject Ho

SMA is Students' Mathematics Achievement

From Table 4, the relationship between anxiety and mathematics achievement has a significant value of .000. This value is less than the set alpha value of .05 (.000<.05). Hence, the null hypothesis that there is no significant relationship between anxiety and Mathematics achievement is rejected. The implication is that the relationship between anxiety and Mathematics achievement (though negative) is statistically significant.

Table 5: Variance in achievement explained by Anxiety

Model	R	R Square	Adjusted R – square	Standard error of the estimate.
1	.933	.870	.868	4.225

a. Predictors & (Constant), Anxiety.

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b. Dependent variable; achievement

From Table 5 above, the R square of .870 shows that the percentage of the variance in achievement that can be explained by combination of anxiety is 87%. The remaining 13% can be accounted for by other variables not studied.

Table 6: ANOVA Summary of Multiple regression analyses of predicting students' mathematics achievement with Anxiety

Model	Sum of squares	Df	Mean square	F	Sig
Regression	21010.685	3	7003.562	392.270	.000
Residual	3142.293	176	17.854		
Total	24152.978	179			

a. Dependent variable: achievement
b. Predictors (constant), Mathematics anxiety.

From Table 6, F value of 392.270 is significant at .05 level of significance, as the p-value (P=.000), is lower than the set alpha level of .05 (.000<.05). These indicate that the regression model shown below is properly fitted. The hypothesis that anxiety do not significantly predict achievement in mathematics is accepted. Hence, anxiety is plausible predictors of Mathematics achievement. Also, the equation or model of the relationship between Mathematics achievement and Anxiety?

Table 7: Multiple regression analyses of predicting student's mathematics achievement with anxiety

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	20.851	3.707		5.626	.000
	Mathematics Anxiety	-.439	.041	-.518	-10.683	.000

a. Dependent Variable: Mathematics Achievement

From Table 7, the regression model can be represented as SMA = C + a_1x_1

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Where SMA is students' mathematics achievement, C is the regression constant, ai is the unstandardized beta coefficients (B), and x1 is anxiety. Hence, the model is: SMA = 20.851 - .439 (anxiety). The coefficients indicate the contribution of each factor in predicting achievement in Mathematics.

Table 8: Contribution of Anxiety in Predicting Mathematics Achievement

Variable	Coefficient	Standard error
Anxiety	-.439	.041

Source: Extract from Table 7

From Table 8, the regression model, the coefficient for anxiety is -.439. This means that for every unit increase in anxiety, there is a decrease of .439 in mathematics achievement. Hence, anxiety contributes negatively to predicting achievement in Mathematics.

Table 9: Significance of Contribution of Anxiety in predicting Mathematics Achievement

Variable	Coefficient	T-value	Sig	Decision
Anxiety	-.439	-10.683	.000	Reject Ho

From Table 9, the t-value for anxiety is -10.683 with a significance value of .000. Since the significance value is less than the set alpha value of .05 (.000<.05), the null hypothesis that anxiety does not significantly predict students' achievement in Mathematics is rejected. The implication is that anxiety is a significant negative predictor of achievement in Mathematics.

Table 10: Moderating Influence of gender on relationship between mathematics achievement and anxiety

Model	R	R square	R square change
1	.184	.034	.034
2	.216	.047	.013

Table 10 provides results in two models (I and 2). Model 1 presents the results of predicting mathematics achievement with gender and anxiety, whereas Model 2 presents the results when the interaction of the moderating variable (gender) is added. The table shows R-square Statistics of .034, when gender and anxiety are used to predict Mathematics achievement in model 1. Model 2 shows the R-squared Statistics of .047 when the interaction of gender with each of the variables is introduced to moderate the

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prediction of Mathematics achievement with anxiety. The R-square change statistics is .013. R-squared change shows the increase in variation in mathematics achievement explained by the addition of the moderating variable (gender). The result shows that the percentage increase in the variation explained by the moderating influence of gender is 1.3%.

Table 11: Gender moderated regression analysis of anxiety in predicting achievement in mathematics

Model	R	F change	Sig F – Change	Decision
1	.184	1.540	.193	Do not reject Ho
2	.216	.762	.517	

Table 11 presents the f-change statistics with the introduction of the moderator variable (gender) as .762 with a significance of .517. Hence, the null hypothesis that gender does not significantly moderate the prediction of Mathematics achievement with anxiety is not rejected (P = .517 > .05). We conclude that gender does not significantly moderate the prediction of mathematics achievement with anxiety. It is therefore evident that the percentage increase in the variations explained by the moderator variable is not statistically significant.

Summary of major findings/Conclusion

1. There is a significant high and negative relationship between anxiety and achievement in Mathematics (r = –.894, P=.000) and anxiety explains 79.9% variance in Mathematics achievement (r^2 = .799)
2. Anxiety significantly predict achievement in mathematics among secondary school students (F=392.270, P=.000, R square=.870), with the percentage of the variance in achievement explained by anxiety as 87%.
3. The regression model of achievement and anxiety is SMA = 20.851 - .439 (anxiety). The coefficients indicate the contribution of each factor in predicting achievement in Mathematics.
4. Anxiety is a significant negative predictor of achievement in Mathematics (c=-.439, t=-10.683, p=.000).
5. Gender does not moderates the prediction of mathematics achievement with anxiety (F change=.762, p=.517)

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