SELF-CONCEPT AND MATHEMATICS ACHIEVEMENT IN SENIOR SECONDARY SCHOOL II IN AKWA IBOM STATE

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ABSTRACT

The research investigates Self-concept on mathematics achievement among Senior Secondary School II students in Akwalbom State, Nigeria. The study aims to uncover the influence of these psychological factors on students' academic performance in mathematics, a subject critical to various fields including science, technology, and finance. Utilizing a predictive research design, this study focuses on the relationship between these affective factors and students' mathematics achievement, while also incorporating gender as a moderating variable. Data were collected from 180 randomly selected students across six public secondary schools in Abak Local Government Area. The instruments for data collection were Mathematics Achievement Test (MAT), alongside structured questionnaires to measure and self-concept. The questionnaires were constructed using a 4-point Likert scale to capture the degree of agreement or disagreement on various statements related to students' emotions and attitudes toward mathematics. These instruments were validated by three experts (one from mathematics education and two from measurement and evaluation). The reliability of Mathematics Achievement Test (MAT) was established using Kuder-Richardson formula 20 (K-R20) and a coefficient of 0.798 obtained. Cronbach's Alpha (α) was used for the calculation of the reliability indices of Mathematics self-concept scales (0.810). Data were analysed using Pearson product moment correlation, multiple regression and moderated regression. Findings highlight that affective factors such as mathematics Self-concept significantly relates to mathematics achievement, it did not significantly predict mathematics achievement. Gender differences were explored, and results show that gender does not significantly moderate the prediction of mathematics achievement with Self-concept. This study underscores the importance of addressing affective factor in mathematics education. By providing insights into how Self-concept affect learning outcomes, the research recommends educational strategies that enhance students' attitudes towards mathematics.. Furthermore, the research recommends that; Mathematics teachers should create friendly and conducive atmosphere while teaching; accommodate individual differences in learning mathematics.

Key words: *Self-concept, Mathematics Achievement, Gender and Students*

INTRODUCTION

Mathematics is seen by society as the foundation of scientific technological knowledge that is important in social-economic development of a nation (Chinelo 2019). Alechenu (2012) described Mathematics as the "queen" of the sciences without which it would be difficult for people to study other sciences like Physics, Chemistry, Biology and Computer Science/Information Technology. Several factors such as attitude of students and teachers, study habit, teachers' qualification,

teaching methods, school environment, government policy, school location, family types have been identified in several studies as factors influencing students' academic achievement (Asikhia, 2010; Samuel T. Ebong, 2015). As a result,

the researcher hypothesised that mathematical self-concept towards mathematics may be contributing elements to the issue of low academic performance.

Academic achievement of students has always been measured using achievement tests or other forms of standardized examinations and continuous assessment tools (Ihendinihu 2022). Academic achievement is commonly measured through examinations or continuous assessments but there is no general agreement on how it is best evaluated or which aspects are most important (Zhou Zheng 2022).Balarabe and Bakare (2013) defined academic self-concept as an evaluative self-perception that is through the student's experience and interpretation of the school environment. Academic self-concept (ASC) is one's academic self-perceptions of one's general ability in school (Shavelson*et. al..,*1976). Mathematics self-concept has "to do with how sure a person is of being able to learn new topics in mathematics, perform well in mathematics class, and do well on mathematics tests".

Various researchers have also studied the impact of student's affective factor and mathematics achievement; Kingsley, *et al* ..,(2024), examine achievement goal orientation and academic self-concept as predictors of secondary school students' academic achievement in Mathematics in Anambra State. Four research questions and three null hypotheses guided the study. The study adopted predictive correlational research to provide answers to the research questions and testing of the hypotheses. The population of the study comprised 21204 from which a sample of 750 was drawn. Multi-stage procedure was used to select the sample. Standardized research instruments namely; Achievement Goal Orientation Questionnaire (AGOQ) and Self-Description Questionnaire (SDQ) were used for data collection. Students' Mathematics Achievement Scores (SMAS) from the state-wide promotion examination were used to represent mathematics achievement. Cronbach's alpha was used to determine the reliability of the items in the instruments.

A reliability index of 0.84, 0.72, 0.86, 0.74 and 0.87 is known for the mastery-approach, mastery-avoidance, performance-approach, performance-avoidance and academic self-concept respectively. The standard multiple regression was used to analyze the collected data. The research question 1 was answered using multiple regressions. Research question 2 was answered using unstandardized β. Research question 3 was answered using adjusted R2. Research question 4 was answered using standardized β. The null hypothesis 1 was tested using the F-test for the regression model. The null hypothesis 2 was tested using a t-test for adjusted R2. The null hypothesis 3 was tested using a t-test for β at a .05 level of significance. Findings showed that students' achievement goal orientation and academic self-concept scores jointly predicted their academic achievement scores in mathematics. It was indicated that mastery avoidance, and work avoidance, relatively and significantly predicted academic achievement in mathematics, while mastery-approach, performance approach, performance avoidance and academic self-concept do not relatively and significantly predict academic achievement in mathematics.

Kojigili (2020) Study Correlates of Self-Concept, Attitude and Mathematics Performance of Senior Secondary School Students in Nigeria; the study investigated the correlates of senior students' mathematics self-concept, attitude, and mathematics performance in secondary school level of Nigeria. The population comprised all the secondary school students from the six states in Northeast, Nigeria. From the population, a total of 589 students were sampled from 18 schools purposively selected from four out of the six states in the zone. The instruments employed for the data collections were Mathematics Achievement Test (MAT) and a Mathematics Self-concept and Attitude Scale (MSCAS). The instruments were validated and the reliability was determined through test re-test method. Using Cronbach alpha analysis, high reliability coefficients of 0.83and 0.915 were obtained for MAT and MSCAS respectively. The statistical tools used in testing the hypotheses were t-test, Analysis of Variance (ANOVA), correlation, and multiple regression analysis. The results of the findings revealed that the students' self-concept correlates significantly with their attitude; and relationship exists significantly among students' self-concept, attitude and their performance. It was recommended among other things that students' mathematics self-concept and attitude be improved in schools by making the teaching of mathematics practical oriented such that students see it interesting and pleasurable.

Significance of the Study

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

Scope of the Study

This study is limited to the students' affective factors such as Self-concept and mathematics achievement in AkwaIbom State secondary schools. The study was restricted to male and female senior secondary two (SS 2) students in some selected public schools.

Purpose of the Study

The purpose of this study is to:

1. Examine the relationship between self-concept and students' achievement in mathematics.
2. Determine the percentage of achievement in mathematics and the model or equation of the relationship between Mathematics achievements can be explained by Self-concept.
3. Determine the contribution of self-concept in predicting achievement in Mathematics
4. Determine the moderating influence of gender in predicting students' achievement in mathematics with Self-concept.

Research Questions

The following research questions are stated for the study;

1. What is the relationship between self-concept 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 self-concept.
3. Determine the contribution of self-concept in predicting achievement in Mathematics
4. To determine the moderating influence of gender in predicting students' achievement in mathematics with self-concept.

Hypotheses

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

i. H_0: There is no significant relationship between student's Self-concept and Mathematics Achievement.

ii. H_0: Self-concept do not significantly predict achievement in mathematics among Secondary school students.

iii. H_0: Self-concept does not significantly predict students' achievement in Mathematics.

iv. H_{04}: Gender does not significantly moderate prediction of Mathematics achievement with Self-concept.

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 to which the independent variables predict the dependent variable. Hence, mathematics achievement will be predicted using Self-concept 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. 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 kilometers (Samuel T. EBONG *et al .., 2014,* Ebong, S. T 2023).

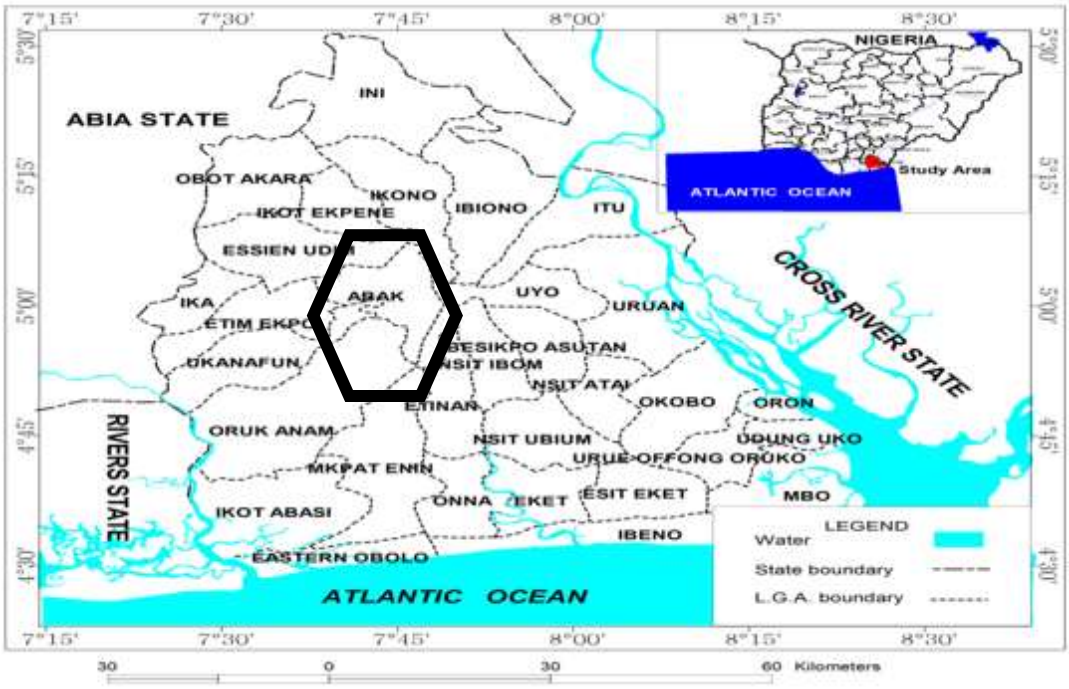

Figure 1: Map of AkwaIbom State indicating the study location (Samuel T. Ebong 2023; Ebong, S. T.*et al..,2023*).

Population of the Study/ Sample and Sampling Techniques

The population for this study is made up of 1110 senior secondary two (SS 2) mathematics students in ten secondary schools within Abak L.G.A of Akwa Ibom State. There are ten (10) public secondary schools in Abak. The sample was made up of 180 out of 1110 SS2 mathematics students drawn from the six (6) public secondary schools in Abak. For us to have the true nature of Abak indigenes the researcher selected six (6) secondary schools from the rural communities / clan neglecting the urban region to reduce influx of visitors that are not indigenes of Abak due to their exposure (Attai, Ekaette, Samuel *et al..,* 2015). From the six (6) selected secondary schools, the researcher employed simple random sampling technique to select 180 students from the six schools in the study area which comprises (15 boys and 15 girls) 30 students were drawn from six (6) schools.

Instruments for Data Collection

A structured self concept scale was carefully constructed for data collection on students' self-concept 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, (Ebong, S.T. *et al.., 2016).*

Mathematics achievement test (MAT)

The achievement test was constructed by the researcher which consists of 30-item multiple-choice questions from the SS2 Mathematics curriculum. The responses of the subjects on MAT was marked and scored accordingly. For consistency and objectivity in scoring the students test items, marking guide was developed by the researcher. The table of specification that guided the 30-item multiple-choice questions is showed in Table 1, While Table 2 indicate the computation and analysis of the blue print (Samuel T. Ebong, *et al..,* 2025).

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**

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 and 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 Mathematics Achievement Test (MAT) was determined by using 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 Mathematics Self- concept Scale (MSCS).The reliability indices were found to be 0.810 (81.0%) approximately. This was considered to be high enough for a good internal consistency.

Method of Data Analysis

The methods or statistical tools used in the analyses of raw data obtained in this study are dictated 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 0.05 level of significance as well as multiple regression analyses and moderated regression. Meanwhile, in testing of hypotheses, the hypothesis of no significant difference was rejected where the p-value or significance of r is less than the alpha value of 0.05; it was not rejected where the p-vale is equal or greater than the alpha value of 0.05. For moderated regression, the decision is based on f-change statistics.

Results and Discusion

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

Research question 1: What is the relationship between self-concept and students' achievement in mathematics?

Table 3: Relationship between self-concept and achievement in Mathematics

Variables	N	R	R^2
Self-concept SMA	180	.809	.654

SMA is Students' Mathematics Achievement

Table 3 indicates that the correlation coefficient between self-concept and Mathematics achievement is .809. Hence the relationship between self-concept and Mathematics

achievement is high and positive. The implication is that as self-concept increases, Mathematics achievement also increases. The coefficient of determination (R^2) of .654 shows that about 65.4% variance in Mathematics achievement can be explained by students' self-concept.

Hypothesis 1: There is no significance relationship between Self-concept and Mathematics achievement.

Table 4: Significance of relationships between self-concept and Mathematics achievement

Variables	N	R	Sig	Decision
Self-concept SMA	180	.809	.000	Reject Ho

SMA is Students' Mathematics Achievement

Result in Table 4 shows that the significance level of the relationship between self-concept and achievement in Mathematics is .000. Since .000 is less than the set alpha level of .05 (.000 < .05), the null hypothesis is rejected. The implication is that the positive relationship between self-concept and achievement in Mathematics is significant.

Research question 2: What is the percentage of achievement in mathematics that can be explained by Self-concept?

Table 5: Variance in achievement explained by Self-concept

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

a. Predictors & (Constant) Self-concept.
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 Self- concept is 87%. The remaining 13% can be accounted for by other variables not studied.

Hypothesis 2: Self-concept do not significantly predict achievement in mathematics

Table 6: ANOVA Summary of Multiple regression analyses of predicting students' mathematics achievement with Self-concept.

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 Self-Concept.

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. Henceself-concept is plausible predictors of Mathematics achievement. Also, the equation or model of the relationship between Mathematics achievement and self-concept?

Table 7: Multiple regression analyses of predicting student's mathematics achievement with self-concept

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	*Std. Error*	*Beta*		
1	(Constant)	20.851	3.707		5.626	.000
	Self concept	-.054	.079	-.042	-.678	.499

a. Dependent Variable: Mathematics Achievement

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

Where SMA is students' mathematics achievement, C is the regression constant a_i is the unstandardized beta coefficients (B), x_1 is self-concept. Hence the model is;
SMA = 20.851 -.054 (self -concept).

The coefficients indicate the contribution of each factor in predicting achievement in Mathematics.

Research question 3: What is the contribution of self-concept in predicting achievement in Mathematics?

Table 8: Contribution of self-concept in Predicting Mathematics Achievement

Variable	Coefficient	Standard error
Self- concept	.-.054	.079

From Table 8 and the regression model, the coefficient for self-concept is -.054. This means that for every one unit increase in self-concept, there is a decrease of .054 in mathematics achievement. Hence, self-concept contributes negatively in predicting achievement in Mathematics. However, it will be observed that this coefficient is very small and negligible
.

Hypothesis 3: Self-concept does not significantly predict students' achievement in Mathematics

Table 9: Significance of Contribution of self-concept in predicting Mathematics Achievement

Variable	Coefficient	T-value	Sig	Decision
Self-concept	-.054	-.678	.499	Do not reject Ho

From Table 9, the t-value for self-concept is -.678 with a significance value of .499. Since the significance value is greater than the set alpha value of .05 (.499>.05), the null hypothesis is not rejected. The implication is that self-concept does not significantly predict achievement in Mathematics.

Research question 4: What is the moderating influence of gender in predicting students' achievement in mathematics with self-concept?

Table 10: Moderating Influence of gender on relationship between mathematics achievement and self-concept.

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 result of predicting mathematics achievement with gender and self-concept, whereas model 2 presents the result when the interaction of the moderating variable (gender) is added. The table shows R square statistics of .034, when gender and self-concept 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 prediction of Mathematics achievement with self-concept. 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%.

Hypothesis 4: Gender does not significantly moderate prediction of Mathematics achievement With and Self-concept.

Table 11: Gender moderated regression analysis of Self-concept 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 is not rejected (P =

.517 > .05). We conclude that gender does not significantly moderates the prediction of mathematics achievement with interest, anxiety and self-concept. It is therefore evident that the percentage increase in the variations explained by the moderator variable is not statistically significant.

Summary of Findings

1. The relationship between self-concept and Mathematics achievement is high, positive and statistically significant (r=.809, p=.000) and self-concept explains 65.4% variance in mathematics achievement (r^2 = .6545).

2. Self-concept 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 self- concept as 87%.

3. The regression model of achievement and self-concept is SMA = 20.851 -.054 (self -concept). The coefficients indicate the contribution of each factor in predicting achievement in Mathematics.

4. Self-concept does not significantly predict achievement in Mathematics(c=-.054, t=-.678,p=.499).

5. Gender does not moderates the prediction of mathematics achievement with self-concept (F change=.762, p=.517).

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