



Interest, Self-Efficacy and Test Anxiety as Predictors of Secondary School Students' Achievement in Geometry

Okeke, A. M., Aneshie-Otakpa, V. O., Orga, A. C., & Nwanchor, M.

Department of Science Education, University of Nigeria, Nsukka.

Corresponding Author: aneshieale@gmail.com

Abstract

The study investigated students' interest, self-efficacy and test anxiety as predictors of secondary school students' achievement in geometry. Four research questions and four hypotheses guided the study. It was correlational survey research. The population of the study was 926 SS II students. The sample was 200 SS II students drawn using two stage sampling procedure. Four instruments' Students Mathematics Interest Inventory (SMII)', Students' self-efficacy Questionnaire (SSQ), 'Test Anxiety Questionnaire (TAQ)' and Geometry Achievement Test (GAT) were used to collect data. Data were analyzed using simple linear regression analysis. Findings among others showed that: students' interest, self-efficacy and test anxiety significantly predicts secondary school students' achievement in geometry. It was recommended among others that: In-service training should be provided for teachers so as to equip them with abilities to teach using students' centred teaching methods.

Keywords: Interest, Self-efficacy, Test Anxiety, Achievement, Geometry.

Introduction

Mathematics is critical to a country's technological development since it is essential for citizens to carry out their daily responsibilities properly. In addition to technology, engineering, medicine, economics, business, and agriculture, mathematics is essential in a range of fields. As a result, the Federal Republic of Nigeria (FRN, 2014) designated mathematics as a fundamental subject to be taught from primary to secondary school in its national education policy. To emphasize the importance of mathematics, the West African Examination Council (WAEC, 2018) stated that applicants for the best job opportunities will need to have a thorough understanding of mathematics, among other things.

Despite the importance of mathematics, students' achievement has been low and/or inconsistent across time. Previous reports have revealed that students' mathematics achievement has been inadequate. The achievement of secondary school students in mathematics has been falling since 2009, according to WAEC results. According to Zalmon and Wanu (2017), the pass rate of students in WAEC Mathematics from 2010 to 2016 was: 2010 (33.95 percent), 2011 (38.93 percent), 2012 (49.00 percent), 2013 (31.30 percent), 2014 (31.30 percent), 2015 (34.18 percent), and 2016 (34.18 percent) (34.18 percent). The preceding statistic clearly indicates that students are underachieving in mathematics. Geometry

is one area in the subject with the lowest level of achievement because it was identified as a weak spot for students by WAEC (2010-2019). Geometry is an area of mathematics concerned with the qualities, relationships, and measurement of points, lines, curves, and surfaces, according to Usman, Agah, and Okafor (2017). The current study was prompted by this failure in geometry to investigate the factors that influence students' geometry achievement.

Poor mathematics achievement has been connected to students' interest, self-efficacy, and high levels of anxiety, according to previous studies (Putwain, Sander, & Larkin, 2013; Anigbo, 2016). As a result, more research into the relationship between interest, self-efficacy, and test anxiety is needed to see how well they predict students' geometry achievement. Interest is a subjective feeling of intentness that is expressed through an action (Usman, 2010). It is the desire or eagerness to begin and continue engaging in any activity that gives one pleasure (Owora & Chika, 2019). This indicates that interest refers to a person's predisposition to engage in a certain activity, such as solving a mathematics problem. As a result, students who are interested in mathematics can actively participate in their learning, and vice versa. Students' interest and attitude influence students' performance, according to a prior study by Kpolovie, Joe, and Okoto (2014), accounting for 21.60 percent of the variance in students' academic achievement. According to Tembe, Anyagh, and Abakpa (2020), there is a considerable

link between mathematics interest and students' achievement in mathematics.

Another factor that might influence how people believe about their abilities and how effective they are is self-efficacy. The belief in one's ability to perform desired actions is known as self-efficacy (Putwain, Sander, & Larkin, 2013). Individuals' actions are influenced by their views of their abilities and the results of their efforts, and self-efficacy refers to their belief in their ability to learn or perform well (Ugwuanyi, Okeke & Asomugha, 2020). Previous research by Ugwuanyi, Okeke, and Ageda (2020) found a significant positive association between self-efficacy and learner performance, while Odiri (2020) discovered a significant relationship between students' self-efficacy and mathematics achievement.

Another element that can affect a student's performance is test anxiety. Test anxiety, according to Ramirez and Beilocks (2011), is a sensation of disquiet brought on by worry or fear before, during, or after a test. When one's abilities are tested, appraised, and graded, the authors claim that everyone experiences test anxiety. Many students have test anxiety when it comes to mathematics, which makes them fearful, anxious, and uninterested in the subject (Yahya & Amir, 2018). Mathematics anxiety has been shown to have a negative impact on students' achievement at all levels (Ersozlu & Karakus, 2019), affect students' abilities (Jatisunda Kania, Suciawati, & Nahdi, 2020), and lead to failure in mathematics (Jatisunda Kania, Suciawati, & Nahdi, 2020). Mkpaoro and Nwagu (2019) found a high positive link between students' test anxiety and their academic achievement in mathematics. According to Owan, Eno, and Uwase (2019), there is an inverse significant association between students' test anxiety and mathematical performance.

Although studies have been conducted on the relationship between students' interest, self-efficacy, and test anxiety and student achievement in geometry, many of these studies have focused on the relationship between one or two of the variables and student achievement in geometry, leaving out the joint relationship among the variables. Furthermore, the vast majority of them are international works of literature. The current analysis was prompted by these gaps in the literature in the Nigerian setting. The study's purpose was to see how much interest, self-efficacy, and test anxiety can predict secondary school students' geometry achievement in Ebonyi State's

Ikwo Local Government Area. To address this situation, the following research questions were posed.

Research Questions

1. What is the predictive power of interest on secondary school students' achievement in geometry?
2. What is the predictive power of self-efficacy on secondary school students' achievement in geometry?
3. What is the predictive power of test anxiety on secondary school students' achievement in geometry?
4. What is the regression model for predicting secondary school students' academic achievement in geometry by their interest, self-efficacy and test anxiety?

Hypotheses

The following hypotheses are formulated and will be tested at .05 level of significance

H0₁: Interest does not significantly predict secondary school students' achievement in geometry.

H0₂: Self-efficacy does not significantly predict secondary school students' achievement in geometry.

H0₃: Test anxiety does not significantly predict secondary school students' achievement in geometry.

H0₄: The regression model for predicting secondary school students' achievement in geometry by their interest, self-efficacy and test anxiety is not statistically significant.

Methods

The study adopted a correlational research design. The study was conducted in Ikwo Local Government Area Ebonyi State. The population of the study is 926 SS II students in the 23 secondary schools in Ikwo. The sample size comprised of 200 students drawn using two stage sampling procedure. Four instruments titled: 'Students Mathematics Interest Inventory (SMII)', Students' self-efficacy Questionnaire (SSQ), 'Test Anxiety Questionnaire (TAQ)' and Geometry Achievement Test (GAT) were developed by the researcher for data collection. The SMII is a 10-item instrument that elicited information on students' interest in mathematics. The SSQ is also a 10-item instrument that elicited information on students' self-efficacy belief towards mathematics. The TAQ is also

a 10-item instrument that elicited information on students' test anxiety towards mathematics. The instruments were rated on a modified four-point likert style questionnaire with response options of Strongly Agree, Agree, Disagree and Strongly Disagree with numerical values of 4, 3, 2, and 1 respectively. The Geometry Achievement Test (GAT) is a 20-item multiple choice questions with response options of A, B, C and D. The GAT was prepared following bloom taxonomy of educational objectives. A test blue print was prepared for the test and weights assigned to the cognitive domains and the contents. The test covered the content of geometry for SS II. 50% was assigned to circles and tangents while 50% was assigned to co-ordinate geometry.

The GAT was subject to content validity as explained above. The SMII, SSQ, TAQ and the GAT were faced validated by three experts, two from Mathematics Education Unit and one from Measurement and Evaluation Unit, all from the Department of Science Education, University of Nigeria, Nsukka. The SMII, SSQ, TAQ and the GAT were trial tested on 30 students in a secondary school in Onicha LGA. The internal consistency reliability coefficients of the SMII, SSQ and TAQ were established using Cronbach alpha method with that of the GAT was established using Kuder-Richardson 20 method. The reliability coefficients of the SMII, SSQ and TAQ were 0.876, 0.791 and 0.866 respectively while the reliability coefficient of the GAT was 0.908.

The method of data collection was direct delivery method. The instruments were administered on the students on the spot and retrieved back upon completion by the students to ensure a high percent of return rate of the instruments. Data were analyzed using linear regression. The research questions were answer using the coefficient of determination (r) and the coefficients of determination (r^2). The hypotheses were tested at 0.05 level of significance using the regression ANOVA F test.

Table 1: Pearson's product moment correlation analysis the predictive power of interest on students' achievement in geometry

Variable	N	\bar{X}	SD	r	r^2
Students' interest in geometry	200	30.18	4.21	0.336	0.113

Students' achievement in geometry	29.51	6.75
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Note: N = Number of respondents, \bar{X} = Mean, SD = Standard Deviation, r = Correlation coefficient, r^2 = Coefficient of determination. The interpretation of the correlation coefficient (r) is in line with Nwana's (1979) criteria, where an r of 0.00 - 0.19 implies very low relationship, 0.20 - 0.39 implies low relationship, 0.40 - 0.59 implies medium/moderate relationship, 0.60 - 0.79 implies high relationship while 0.80 and above implies very high relationship.

Result in Table 1 shows that the correlation coefficient (r) of 0.336 and a coefficient of determination (r^2) of 0.113 were obtained. The correlation coefficient (r) of 0.336 means that there is a positive but low relationship between the variables. In other words, there is a positively low relationship ($r = 0.336$) between students' interest in geometry and students' achievement in geometry. Furthermore, the coefficient of determination (r^2) of 0.113 implies that 11.3% of secondary school students' achievement in geometry is predicted by their interest in geometry

Table 2: ANOVA of the significance of the prediction of secondary school students' achievement in geometry by their interest in geometry

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1017.549	1	1017.549	25.050	.000 ^b
1 Residual	8002.190	197	40.620		
Total	9019.739	198			

a. Dependent Variable: achieve b. Predictors: (Constant), interest.

The result in Table 2 showed that students' interest in geometry significantly predicts' secondary school students' achievement in geometry ($F(1, 198) = 25.05$, $p < .05$), thus the hypotheses was rejected. This is because associated probability (p) value of 0.000 is less than 0.05 level of significance. Thus inference drawn is that students' interest in geometry significantly predicts' secondary school students' achievement in geometry

Table 3: Pearson's product moment correlation analysis of the predictive power of self-efficacy on students' achievement in geometry

Variable	N	\bar{X}	SD	R	r^2
Students' self-efficacy					

towards geometry Students' achievement in geometry	200	31.40	4.86	0.318	0.1011
		29.51	6.75		

Result in Table 3 showed that the correlation coefficient (r) of 0.318 and a coefficient of determination (r²) of 0.1011 were obtained. The correlation coefficient (r) of 0.318 indicates that there is a low relationship between the variables. This can also be interpreted to mean that, there is a positively low relationship (r = 0.318) between students' self-efficacy towards geometry and students' achievement in geometry. In addition, the coefficient of determination (r²) of 0.1011 implies that 10.11% of students' achievement in geometry is predicted by their self-efficacy towards geometry.

Table 4: ANOVA of the significance of the prediction of secondary school students' achievement in geometry by their self-efficacy towards geometry

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	913.404	1	913.404	22.198	.000 ^b
Residual	8106.334	197	41.149		
Total	9019.739	198			

a. Dependent Variable: achieve b. Predictors: (Constant), selfeff

The result in Table 4 showed that students' self-efficacy towards geometry significantly predicts' secondary school students' achievement in geometry ($F(1, 198) = 22.198, p < .05$), thus the hypotheses was rejected. This is because associated probability (p) value of 0.000 is less than 0.05 level of significance. Inference drawn is that students' self-efficacy towards geometry significantly predicts' secondary school students' achievement in geometry.

Table 5: Pearson's product moment correlation analysis of the of the predictive power of test anxiety on students' achievement in geometry

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	F Change	df1	df2	Sig. F Change
1	.474 ^a	.225	.213	5.988	.225	18.862	3	195	.000

a. Predictors: (Constant), testanx, selfeff, interest

Variable	N	\bar{X}	SD	R	r ²
Students' test anxiety towards geometry	200	24.28	4.973	-0.303	0.092
Students' achievement in geometry		29.51	6.75		

The result in Table 5 showed that the correlation coefficient (r) of -0.303 and a coefficient of determination (r²) of 0.092 were obtained. The correlation coefficient (r) of -0.303 depicts that there is a low inverse relationship between the variables. Furthermore, the coefficient of determination (r²) of 0.092 is an indication that 9.2% of students' achievement in geometry is predicted by their test anxiety towards geometry.

Table 6: ANOVA of the significance of the prediction of secondary school students' achievement in geometry by their test anxiety towards geometry

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	830.720	1	830.720	19.984	.000 ^b
Residual	8189.019	197	41.569		
Total	9019.739	198			

a. Dependent Variable: achieve b. Predictors: (Constant), testanx

The result in Table 6 showed that students' test anxiety towards geometry significantly predicts' secondary school students' achievement in geometry ($F(1, 198) = 19.984, p < .05$), thus the hypotheses was rejected. This is because associated probability (p) value of 0.000 is less than 0.05 level of significance. Hence, the conclusion drawn is that students' test anxiety towards geometry significantly predicts secondary school students' achievement in geometry.

Table 7: Pearson's product moment correlation analysis of the regression model for predicting students' academic achievement in geometry by their interest, self-efficacy and test anxiet

The result in Table 7 showed that the correlation coefficient (r) of 0.474 and a coefficient of determination (r^2) of 0.225 were obtained. The correlation coefficient (r) of 0.474 portrays that there is a moderate relationship between the variables and secondary school students' achievement in geometry. That is to say, there is a positively moderate relationship ($r = 0.474$) between students' interest, self-efficacy and test anxiety and secondary school students' achievement in geometry. Additionally, the coefficient of determination (r^2) of 0.225 shows that 22.5% of secondary school students' achievement in geometry is jointly predicted by their interest, self-efficacy and test anxiety towards geometry.

Table 8: ANOVA of the significance of the regression model for predicting students' achievement in geometry by their interest, self-efficacy and test anxiety

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2028.727	3	676.242	18.862	.000 ^b
Residual	6991.011	195	35.851		
Total	9019.739	198			

a. Dependent Variable: achieve b. Predictors: (Constant), testanx, selfeff, interest

The result in Table 8 showed that the predictor variables significantly predicts secondary school students' achievement in geometry ($F(1, 198) = 19.984, p < .05$), thus the hypotheses was rejected. This is because associated probability (p) value of 0.000 is less than 0.05 level of significance. Thus, the conclusion drawn is that students' interest, self-efficacy and test anxiety towards geometry jointly predict secondary school students' achievement in geometry significantly.

Discussions

The study investigated students' interest, self-efficacy and test anxiety as predictors of secondary school students' achievement in geometry. The findings of the study showed 11.3% of secondary school students' achievement in geometry is predicted by their interest in geometry. Further result revealed that students' interest in geometry significantly predicts secondary school students' achievement in geometry. The findings are consistent with findings from earlier studies in similar fields. For example, the findings support previous findings from a study by Kpolovie,

Joe, and Okoto (2014), which found a significant correlation between students' interest and their academic achievement, as well as that their interest in mathematics accounts for 21.60 percent of the variance in students' academic performance. The findings also back up recent research by Tembe, Anyagh, and Abakpa (2020), who found a link between mathematics interest and student achievement in mathematics. The above findings implies that the students' interest towards geometry positively and significantly predict secondary school students' achievement in geometry.

Furthermore, findings revealed that 10.11% of secondary school students' achievement in geometry is predicted by their self-efficacy towards geometry and students' self-efficacy towards geometry significantly predicts secondary school students' achievement in geometry. The findings of Ugwuanyi, Okeke, and Ageda (2020) who found that motivation and self-efficacy showed substantial positive associations with learner performance in Physics confirm the above findings. The findings also back up recent research by Odiri (2020), who found a link between students' self-efficacy and math achievement. This suggests that students' self-efficacy in geometry is linked to and predicts their geometry achievement.

More so, the findings from the study revealed that 9.2% of secondary school students' achievement in geometry is predicted by their test anxiety towards geometry and that students' test anxiety towards geometry significantly predicts secondary school students' achievement in geometry. The above findings is in agreement with previous findings from Owan, Eno and Uwase (2019) revealed amongst others that there is an inverse significant relationship between students' tests anxiety and performance in mathematics. However, the result slightly disagrees with previous findings by Mkpaoro and Nwagu (2019) who reported that that there was a high positive relationship between the students' test anxiety and their academic achievements in mathematics, the relationship is statistically significant. This discrepancy may be due to the fact that Mkpaoro and Nwagu employed location as a moderating variable. The test anxiety ratings of urban students may have a favourable correlation with their achievement scores, influencing the study's total outcomes.

Lastly, the findings of the study showed that 22.5% of secondary school students' achievement in geometry is jointly predicted by their interest, self-



efficacy and test anxiety towards geometry and the prediction is significantly. The above findings lend support to previous studies by Kpolovie, Joe and Okoto (2014) who revealed that a significant correlation and multiple prediction of students' academic achievement with their interest in learning and attitude towards school and that the predictor variables; accounting for 21.60% of the variance in students' academic performance. The findings also agree with previous findings from Iroegbu (2013) there was an interaction of anxiety and self-concept and anxiety, self-concept and gender on academic performance. This means that test anxiety, self-concept and gender jointly predict students' performance. Hence, the findings that secondary school students' achievement in geometry is jointly predicted by their interest, self-efficacy and test anxiety towards geometry is in order.

Conclusion

It was concluded that students' interest, self-efficacy and test anxiety singly and jointly of predict secondary school students' achievement in mathematics.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. In-service training should be provided for teachers so as to equip them with abilities to teach students' centered teaching methods.
2. Government agencies and school administrators should employ teachers that are qualified and competent to effectively teach mathematics.

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