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Examining the Interplay of Student Factors in Senior Secondary School Mathematics Achievement

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Abstract

This study investigated the relationship between student traits (attitude, interest and self-efficacy) and Mathematics achievement in senior secondary schools in Ijebu-Ode, Ogun State, Nigeria. Three hypotheses guided the study. A quantitative approach was used while the research design employed was the descriptive survey. A sample size of 350 students was randomly selected. Two research instruments were used, yielding the reliability coefficient of 0.883 for Students' Attitude, Interest and Self-Efficacy Scale (SAISS) and 0.861 for Mathematics Achievement Test (MAT). Percentage and Analysis of variance (ANOVA) were used to analyze the data. Results showed a substantial relationship between student factors and senior secondary school mathematics achievement with the following results ($F = 26.746$, $p<0.05$); ($F = 0.053$, $p<0.05$); ($F = 27.288$, $p<0.05$). The study concluded that Attitude, Interest and Self-efficacy are strong predictors of Mathematics achievement of senior secondary school students in Ijebu Ode. It is recommended among others that students should always be encouraged about the usefulness of mathematics in their day-to-day activities.

Keywords: Academic achievement, Attitude, Interest, Mathematics, Self-efficacy

INTRODUCTION

No matter what age or situation, mathematics is a topic that permeates daily life. Its importance therefore transcends the classroom and the institution. Thus, [12] asserts that in a school, Mathematics must be studied thoroughly and in-depth. Additionally, a vital subject for today's youth education is Mathematics. It is essential since it affects people's everyday lives all around the world. [13] submits that Mathematics forms the foundation for contemporary inventions, scientific findings, and scholarly investigations. [2] opines that Mathematics has often been perceived as a subject exclusive to science students. However, in today's era of advanced digitalization, science, and technology, its relevance has expanded far beyond just the academia. Therefore, it is a crucial field of study that connects geometry, algebra, and trigonometry in the high school curriculum. [3] underscores the extensive practical applications of Mathematics across various domains, asserting that it serves as a gateway to scientific understanding.

Based on the WAEC results from May/June 2023, only 38.33% of the 416,999 students nationwide who enrolled for the exam were able to pass with at least one credit as reported by [14], pointing out some factors that could have led to such outcomes. This is problematic and necessitates constant investigation to guarantee that student traits to Mathematics (attitude, interest and self-efficacy) improve, thereby bringing about a positive increase in Mathematics achievement. [25] submitted that Mathematics achievement and non-cognitive attributes of students is continuously given attention in various nations since it is thought to

be the primary subject in their developmental learning, emphasising its importance for the expansion and development of the country. In the same vein, factors such as attitude, interest, study habit and self-efficacy contribute to students' low achievement in Mathematics among senior secondary school students in Ijebu Ode, as has been seen from various SSCE results.

Academic achievement refers to how well a learner or institution has met either immediate or future learning objectives. According to [1], achievement is the manifestation of students' capacities to meet standards of learning objectives because of their classroom education and experiences. Additionally, examinations and continuous evaluations are commonly used to gauge students' academic progress, while opinions on the most important aspects and the most effective ways to measure it differ, ([31]; [2]). According to [26], an accomplishment test is primarily a piece of equipment or instrument of assessment that aids in determining the amount and level of education acquired in a subject or set of subjects following a time of instruction by assessing the individual's current abilities.

Mathematics achievement can be high or low due to a variety of variables. [31] lists a number of these elements, including those related to teachers, schools, students, parents, and government. Additionally, [9] reported that a student's background or entry level, anxiety, attitude problems, disinterest in math, self-perception, study habits, drive for success, unfair exposure, self-efficacy, and methods for overcoming problems are some of the elements that lead to poor achievement. Student factors has been considered necessary because it directly affects the wellness of the students since they are the major stakeholders in determining their educational attainment. [2] submits that these factors collectively hinder the consolidation, application, and transfer of mathematical knowledge. Hence, among various factors, attitude, interest and self-efficacy are considered in this study as predictor variables of Senior Secondary School students Mathematics achievement.

According to [24], attitude is defined as an individual's taught disposition or predisposition to react either favorably or unfavorably to an item, circumstance, idea, or other person. Mathematical negativity is widespread and is sometimes referred to as "mathemaphobia" or "disaffection" from a phenomenological standpoint. According to [20], Mathematics suffers from a serious image problem. Significant disparities can also be seen between students in the same mathematics class as well as between classes because attitudes toward Mathematics depend on the experiences of individual students [23]. Additionally, [19] argued that success in Mathematics depends in large part on students' attitudes toward the subject.

More so, self-efficacy in Mathematics is equally critical. It is defined as assurance in one's capacity to organize and execute the steps required to accomplish objectives [11]. [10] submits that individuals with strong views about their own abilities in a particular field behave, think, and feel differently from those with weak beliefs. Also, they exhibit more efficacy, self-control, and persistence [22]. Both highly and low self-efficacious students exist. Moreover, regardless of prior success, high self-efficacy alters behaviors that affect performance in the future [(11); (25)]. Additionally, achievement in Mathematics is strongly correlated with self-efficacy, according to [17]. The way that students feel about Mathematics is closely linked to their level of self-efficacy in the subject. Self-efficacy and viz-a-viz attitude have a major impact on tertiary entry ranks [18].

Additionally, interest is a motivating factor that has been connected to academic success since it increases students' likelihood of participating in class, paying attention, and producing better work. [21] reports that among high school learners, a lack of interest in Mathematics was linked to academic achievement. Furthermore, a study by [28] on the relationship between academic achievement and mathematical interest discovered a substantial difference between secondary school students' academic achievement and their level of interest in Mathematics. Researchers have also suggested that a lack of interest in the subject matter may be linked to learners' inability to succeed in Mathematics [15]. In the view of [16], interest in Mathematics has no discernible impact on the growth of achievement if prior knowledge was considered.

This is of different view with previous researchers but [15] identifies attitudes toward mathematical success, self-efficacy, the conviction that one can master mathematical concepts, perceptions of teachers' attitudes, Mathematics anxiety, and locus of control as factors impacting students' interest in the subject.

Putting all these in mind and knowing that the ability to solve mathematical problems well is essential for determining a student's academic path and prospects. However, there is a persistent challenge in understanding the underlying elements that influence the scholarly success of senior secondary students in the subject in Ijebu Ode. It is critical to comprehend the relationship that exists between senior high school Mathematics achievement in Ijebu Ode, Ogun State, Nigeria, and students' attitudes, interests, and self-efficacy.

Objectives of the study

The main objective of the study is to examine the interplay between student factors - attitude, interest and self-efficay - and senior secondary academic achievement in Mathematics.

Hypotheses

The hypotheses for the research study was developed and examined at the significance level of 0.05:

Ho1: At the senior secondary level, there is no significant relationship between students' attitudes towards Mathematics and their academic achievement.

Ho2: At the senior secondary level, there is no significant relationship between students' interest in Mathematics and their academic achievement.

Ho3: At the senior secondary level, there is no significant relationship between students' self-efficacy towards Mathematics and their academic achievement.

MATERIALS AND METHODS

The research employed a quantitative methodology and used the descriptive survey research design to examine the interplay between the selected student factors (attitude, interest and self-efficacy) in line with Senior Secondary School students' academic achievement in Mathematics. This study's population included every senior secondary public school in Ijebu Ode. Senior secondary students were specifically targeted since they are exposed to a larger portion of the mathematical curriculum at that level, which has gradually built and stabilized their attitudes, interests, and self-efficacy in the subject. 350 students in Senior Secondary School 2 made up the sample size. Seventy (70) students were each selected from five schools in the study area using the simple random sampling technique. The five schools met the criteria of participation, which include: co-educational to give room for gender equity, willingness to participate to ensure consent and having senior sections to be sure of the students' exposure to enough Mathematics content.

Two (2) research instruments, namely, Students' Attitude, Interest and Self-Efficacy Scale (SAISS) and the MAT, or Mathematics Achievement Test, were utilized to gather data from the respondents. The Student's Attitude, Interest and Self-Efficacy Scale (SAISS) is a self-developed questionnaire that comprises 30 items fashioned after the Likert scale, the responses are Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Mathematics Achievement Test (MAT) consists of twenty (20) items taken from topics already covered in Mathematics by all the schools. The items consist of objectives with four choices that are multiple-choice A-D, which includes only one right answer and three wrong answers. All the instruments were revalidated by giving it to experts in field of psychology, Mathematics and Mathematics teachers for both face and content validity. The validated instruments were administered to a different set

of students in another local government to confirm the reliability of the instruments and Cronbach Alpha and split half method was utilized to get the reliability value of 0.883 for Students' Attitude, Interest and Self-Efficacy Scale (SAISS) and 0.861 for Mathematics Achievement Test (MAT). The researcher visited the designated educational institutions and then met with the school authorities and the Mathematics teachers for permission to administer the instruments. After that, the respondents' consent were obtained. They were assured of the confidentiality of the information given. The instruments were then given to the sampled participants aided by two research assistants and the information gathered from the sampled population were analyzed with percentages and Analysis of Variance (ANOVA). This statistical tool is suitable because it gives better understanding and room for comparison between the factors and Mathematics achievement. Also put into consideration were the continuous nature of student achievement and the categorical variables that involve attitude, interest and self-efficacy suitable as predictor variables. These met the requirement for the use of ANOVA.

RESULTS AND DISCUSSION

The respondents' demographic information showing the gender and age differences of the respondents.

Table 1: Distribution of respondents according to sex

Gender	Frequency	Percentage (%)
Male	165	47
Female	185	53
Total	350	100

The table shows the demographic data of the participants: 165 (47%) of the respondents were male, and 185 (53%) were female, this show a kind of gender equality, though the female students are 20 more than the male, showing a high rate of female enrolment in the schools.

Table 2: Distribution of respondents according to age

Age	Frequency	Percentage (%)
13 - 15yeras	218	62
16 – 17 years	118	34
18-20 years	12	4
Total	350	100

A total of 218 (62.3%) of the respondents were 15 years, 118 (33.7%) were between 16 and 17 years, and 14 (4%) were 18 years, showing the different range of maturity of the students with larger population at the sensitive age.

Hypotheses Testing

Ho1: At the senior secondary level, there is no significant relationship between students' attitudes towards Mathematics and their academic achievement

Table 3: ANOVA of Attitude on Students' achievement in mathematics.

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1126.840	1	1126.840	26.746	.027[b]
Residual	14661.670	348	42.131		
Total	15788.510	349			

*** Significant of F at α = .05**

a. Dependent Variable: Students' achievement mathematics

b. Predictors: (Constant): Attitude

Table 3 reveals a significant connection between students' attitudes and their academic achievement in Mathematics. The analysis shows that students' attitudes have a substantial impact on their academic performance, with a *p-value* of *0.027* (less than *0.05*) and *F value of 26.746*. This indicates that attitude is

a strong predictor of academic achievement in Mathematics among secondary school learners. Therefore, the null hypothesis is rejected.

Ho2: At the senior secondary level, there is no significant relationship between students' interest in Mathematics and their academic achievement.

Table 4: ANOVA of Interest on Students' achievement in mathematics.

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.393	1	2.393	0.053	.003[b]
Residual	15786.117	348	45.362		
Total	15788.510	349			

*** Significant of F at α = .05**

a. Dependent Variable: Students' achievement mathematics

b. Predictors: (Constant): Interest

Table 4 reveals a significant connection between secondary school learners' interest in Mathematics and their academic achievement. The analysis indicates that students' interest has a notable impact on their academic performance, with a *p*-value of 0.003 (less than 0.05). However, the *F* value of 0.053 suggests that the predictive effect of interest on academic success in Mathematics is relatively weak. Therefore, the null hypothesis is rejected.

Ho3: At the senior secondary level, there is no significant relationship between students' self-efficacy towards Mathematics and their academic achievement.

Table 5: ANOVA of Self-efficacy on Students' achievement in mathematics.

Model	Sum of Squares	Df	Mean Square	*F*	Sig.
Regression	1148.016	1	1148.016	27.288	.026[b]
Residual	14640.494	348	42.070		
Total	15788.510	349			

*** Significant of F at α = .05**

a. Dependent Variable: Students' achievement mathematics

b. Predictors: (Constant): Interest

Table 5 reveals a significant association between secondary school students' self-efficacy and their academic achievement in Mathematics. The analysis indicates that students' self-efficacy has a substantial impact on their academic performance, with a *p-value* of 0.026 (less than 0.05) and *F* value of 27.288. This suggests a strong predictive effect of self-efficacy on academic success in Mathematics.

Discussion of Findings

Findings show the existence of a strong association between the attitudes of Senior Secondary School Mathematics learners and their academic achievement, with a strong predictive effect of attitude on achievement. This implies that the attitude of this set of students determines their success in Mathematics, as some of them do not really like Mathematics pointing to negative attitude towards the subject which aligns with [20], who submitted that negative attitudes towards Mathematics are common. The findings corroborate the result of [19] that revealed that students' attitudes towards Mathematics are significant for attaining success in the subject. This is also supported by [6] and [8] both researchers laying emphasis on the strong link between academic success in junior high school and post-secondary education and attitude. Additionally, the result revealed that the interest of learners in Senior Secondary School Mathematics and their scholastic achievement is significantly correlated, though it shows a weak predictive effect, this may be due to the operational way the instrument was captured not putting into consideration some contextual factors that may have accounted for a full range of student's interest in this region. Although, the result aligns with the conclusion of [16] and [5] that stated that learners' interest for both English and Mathematics has no discernible impact on the growth of achievement if prior knowledge was taken into account. However,

the present findings align with the conclusion of [4] and [7] that both concurred that learners' academic achievement is positively impacted by their interests. Furthermore, the results showed a strong correlation between Senior Secondary School students' academic achievement and their level of self-efficacy in Mathematics. These findings corroborate the study of [17] that demonstrated a significant correlation between math achievement and self-efficacy. These outcomes align with [30]; [29] and [7] which determined that there is a substantial correlation between academic success and self-efficacy in senior secondary schools. The results are consistent with the social cognitive theory of Bandura which maintains that individuals' motivation and performance are influenced by their ideas about their own efficacy.

CONCLUSION

The study's conclusion indicates that, in Ijebu Ode, Ogun State, Nigeria, students' factors (attitude, interest, and self-efficacy) and their performance in Mathematics at the Senior Secondary School level are significantly correlated. It is recommended, that future research could explore the underlying mechanisms through which students' attitude, interest, and self-efficacy impact their academic achievement in Mathematics using larger sample size or different regions in line with other cognitive and non-cognitive factors. Additionally, future researchers could consider looking at other approaches like experimental studies to give a robust detail on each variable and using path analysis to get the relationship among the independent variables. Also, it should be acknowledged that the sample size may not be a true representation of every secondary school learner in Ogun State, Nigeria, therefore it is only limited to students in Ijebu Ode.

DECLARATION OF INTEREST

There is no conflict of interest with this study.

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