
ATTITUDE AND SEX AS CORRELATORS OF MATHEMATICS ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS IN EDO AND DELTA STATES.

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ABSTRACT

This study investigated sex, attitude, and mathematics achievement among secondary school students in Edo and Delta States. Three research questions were raised and answered. Three hypotheses were also formulated and tested at the 0.05 level of significance. This study adopted a correlational research design. The population of this study was 51,526 Secondary School II (SSII) students in the 792 public secondary schools in Edo and Delta states. The sample of this study was 800 SS2 students drawn from the 80 public secondary schools in Edo and Delta States. The Attitude Towards Mathematics Inventory (ATMI) and the Mathematics Achievement Test (MAT) were used for data collection. The reliability of the MAT was determined using the Kuder-Richardson-21 formula, and the reliability of ATMI was determined using Cronbach's alpha. These yielded a reliability index of 0.73 for the Mathematics Achievement Test (MAT) and an alpha of .795, $p < .05$ for the Attitude Towards Mathematics Inventory (ATMI). The mathematics teachers from the various sampled schools served as research assistants; they directly assisted in administering the instruments to the 800 SS2 students. However, 760, which represent approximately 95% of the total number of administered copies of each instrument, were retrieved and used for data analysis. In the analysis, Pearson Product Moment Correlation (r) and coefficient of determination (r^2) were used to answer the research questions. The hypotheses were tested using regression. The major findings of the study show that there is a significant relationship between attitude towards mathematics and mathematics achievement of secondary school students in Edo and Delta States; between sex and mathematics achievement of secondary school students in Edo and Delta States; among sex, attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States; On the basis of these findings, it was recommended, among others, that Mathematics educators should assess their students' dispositions and provide suitable assistance to foster the cultivation of a favourable mindset towards the subject. More practically, teachers could use the survey utilised in the ATMI to examine their students' level of attitude towards mathematics.

Keywords: Sex, attitude, mathematics, academic achievement

INTRODUCTION

Mathematics is an important subject that plays a crucial role in various aspects of our daily lives. It not only shapes our logical reasoning but also equips us with essential problem-solving skills. In secondary schools, mathematics proficiency is crucial as it forms the foundation for further academic pursuits. Its educational importance stems from the transdisciplinary principles instilled in students through the teaching of a given content.

The subject of mathematics acts as a catalyst for Nigeria's crucial scientific, technical, and socioeconomic progress. The primary goals of mathematics education at the secondary school level, as outlined in the National Policy of Education, are: 1) to instill the appropriate values and attitudes necessary for the individual's and Nigerian society's survival; and 2) to furnish the essential mathematical foundation for further academic pursuits. 3). The acquisition of suitable skills, abilities, and competencies, encompassing both mental and physical capacities, that enable individuals to live and actively contribute to the advancement of their society; 4). to cultivate precise and systematic reasoning skills. 5). In order to foster innovation and originality, 6). to cultivate the capacity to identify problems and resolve them using relevant mathematical expertise. 7). to cultivate the inclination and capacity to be precise to a level that is applicable to the specific problem at hand, 8). to develop an interest in mathematics and provide a solid foundation for everyday living (FME 2018).

In order to realise these lofty objectives, there is a need for better academic achievement among students. The level of academic achievement of students gives a clear indication of whether a school is realising these objectives or not. Academic achievement refers to how far a learner or school has progressed towards short-term or long-term teaching methods. The grade point average is a good way to gauge students' achievement, while the pass rate is a good way to gauge schools' achievement. Academic achievement is the outcome of education. It denotes the level of attainment of an educational objective by a student, instructor, or institution. Academic achievement is the tendency to strive for success and to participate in activities in which success is dependent on a person's effort, skills, courage, perseverance, and ability. Academic achievement is a crucial aspect of learning. It is regarded as the focal point around which the educational system revolves and determines whether an academic institution will succeed or fail (Amalu & Ndifon, 2017).

Given the significance of education in public service, there is a collective desire for public school students to obtain greater quality results. This is because individuals who do not get higher grades or outcomes lack the required talents to successfully contribute to national development. Poor academic achievement not only leads to a negative image of the student, but it also puts an enormous strain on the parents. Given the dynamic role mathematics plays in any society, as discussed above, it is quite appalling and unfortunate to see students fail mathematics examinations. The abysmal achievement of students in both internal and external senior school examinations has been of great concern. What has been a source of concern to all those interested in the education of children is the question of what would have been the cause of this failure.

Consequently, several studies have been undertaken to ascertain the variables that lead to unsatisfactory mathematics achievement among learners in secondary school. Scholars have found that a number of factors affect how well students do in school. These include problems with the school administration, quality assurance practices, school community relationships, students' perceptions, their personalities, their homes, and psychosocial factors (Adeyemi & Adeyemi, 2014). Specifically, Lee et al., (2023) disclosed that learners' disposition, utilisation of teaching aids by educators, and parents' education are

correlates of students' achievement in mathematics. Despite numerous research initiatives by various academics to address problems relating to poor academic achievement in mathematics, the issue still exists among secondary school students. Thus, the rationale for this study stems from the persistent failures that represent poor academic achievement in mathematics which led the researcher to further come up with the view that attitude towards mathematics is a probable factor responsible for the problem of poor academic achievement. The view was borne from personal experience, where many students are afraid when it comes to mathematics.

An attitude may be described as a cognitive disposition to respond to a circumstance with a premeditated response. Attitudes include fundamental perceptions, beliefs, sentiments, emotions, aspirations, and anxieties. Attitude may be described as a cognitive or neurological state that is shaped by past experiences and has a significant impact on an individual's reaction to various things and situations. According to Ünal and Işeri (2012), attitude is a psychological state that arises from experiences and has a significant impact on an individual's behaviour and responses to many objects and circumstances.

Attitude is "a word used as a general tendency or an individual tendency to act in a certain condition". The use of the word attitude is based on what one says, one does and one's visible behaviour. Attitudes can also include how students feel about mathematics and how students feel about themselves as learners. Attitude is the willingness or tendency of a student to act or react to a certain stimulus such as mathematics instruction. The reactions of a person to all things and situations to which they are connected to is based on their attitude, which is a neutral mental state of readiness that has been built up over time. Individuals develop their attitudes; they are not born with them. Shaw and Wright (2017) state that attitudes are not innate; rather, they are learned through different types of education. According to Mazana, *et al.*, (2019) it is a "feeling of happiness in a mathematics classroom. Apart from mathematical ability, aptitude and attitude that have been discussed, the researcher is of the view that sex and school location of students could moderate the possible effect of the relationship among the three independent variables and academic achievement.

Sex is one of the most often mentioned demographic variables that have a substantial impact on student learning outcomes. Sex is a societal categorization that separates the roles, behaviour, mental, and emotional traits produced by a community between humans. Sex is a significant aspect that determines students' job choices or career interests. Fabunmi (2014) stated that sex composition has a substantial association with students' academic achievement and has a significant impact on secondary school students' academic achievement. Furthermore, data on sex differential in academic achievement has been proven to be conflicting (Dania, 2014). These results suggest that the sex differential in mathematics has yet to be concluded. As a result, it is clear that further research is required.

Statement of the Problem

Numerous problems that threaten to obstruct the achievement of its objectives have plagued the teaching and learning of mathematics in secondary schools over the years. Poor academic achievement in mathematics among students, particularly in secondary schools, has been a source of worry for both teachers and parents. Thus, the rationale for this study stems from the persistently poor academic achievement in mathematics that is common to both Delta and Edo States, despite the investment that the government and parents have made in the sector. Statistics released by the West African Examinations Council each time the results are released consistently show that students are performing poorly. Though some research efforts have been made to identify the factors that are responsible for poor academic achievement in mathematics, the problem still persists. Moreover, some of these studies did not really

address some psychological factors that could influence the academic achievement of students in secondary schools. Review of various studies reveal that no previous study has been carried out in Delta and Edo states regarding the influence of attitude on mathematics achievement of secondary school students in mathematics. The researcher is further of the view that demographic factors like sex may moderate the likely relationship between attitude toward mathematics and mathematics achievement among secondary school students. There is inconsistency on relationship among attitude toward mathematics and mathematics achievement among secondary school students on the basis of sex. Therefore, the study focuses on the relationship between attitude and mathematical achievement among secondary school students in Edo and Delta states.

Research Questions

The following research questions guided the study:

1. What is the relationship between attitude towards mathematics and achievement of secondary school students in Edo and Delta States?
2. What is the relationship among sex and mathematics achievement of secondary school students in Edo and Delta States?
3. What is the relationship among sex, attitude towards mathematics and mathematics achievement of secondary school students in Edo and Delta States?

Hypotheses

The following null hypotheses were formulated to direct the study:

1. There is no significant relationship between attitude towards mathematics and achievement of secondary school students in Edo and Delta States.
2. There is no significant relationship between sex and mathematics achievement of secondary school students in Edo and Delta States.
3. There is no significant relationship among sex, attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States.

Purpose of the Study

The purpose of this study is to examine the relationship between attitude and mathematical achievement among secondary school students in Edo and Delta states. Specifically, the study:

1. determined the relationship between attitude towards mathematics and achievement of secondary school students in Edo and Delta States; and
2. ascertain the relationship between sex and mathematics achievement of secondary school students in Edo and Delta States.
3. examined the relationship among sex, attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States.

Research Methods

This study adopted the correlational research design. The population of this study was 51,526 Senior Secondary School II (SSII) students in the 792 public secondary schools in Edo and Delta states. The sample of this study was 800 SS2 students drawn from the 80 public secondary schools in Edo and Delta States. Multi-stage sampling procedures were employed in composing the sample for the study.

The instruments that were used for data collection in this study are the Attitude Toward Mathematics Inventory (ATMI), and Mathematics Achievement Test (MAT). The Attitude Toward Mathematics Inventory (ATMI) was divided into two parts: A and B. Part A

was designed to collect respondents' personal data such as sex (male or female). Part B of the Attitude Towards Mathematic Inventory (ATMI), consists of 34 items. The 34 items were adapted from Tapia and Marsh (2004). In the ATMI, respondents were asked to indicate their opinion on four points scale of "Strongly Agree" (4), "Agree" (3), "Disagree" (2), and "Strongly Disagree" (1).

The second which is Mathematics Achievement Test (MAT) was also divided into two parts: A and B. Part A was designed to collect respondents' personal data such as sex (male or female). Part B of the Mathematics Achievement Test (MAT) consists of 50 multiple choice items with options A-D. The items in the Mathematic Achievement Test (MAT) were adapted from Macrae, et al., (2016). Section A of each of the instrument consists of respondents' personal data. Personal data were collected to enable the researcher to gather data for the analysis of the moderating variables such as sex (male and female).

The face validity of the instrument was determined by an expert in Measurement and Evaluation. The instrument was subjected to content and construct validity after the face validity has been certified by the expert, the content and constructs validity was carried out to ensure that all the variables were addressed in the instrument. The content validity of the Mathematics Achievement Test (MAT) was also carried out by the use of table of specification. The content validity of the Attitude Toward Mathematics Inventory (ATMI) were established using extraction sum of squared loadings. The total Cumulative percentage of all the 34 items in the ATMS was 69.726% of the domain of variable with a total of unexplained variance as 30.274%.

The reliability of the Mathematics Achievement Test (MAT) was carried out using the Kuder-Richardson-21 method. This yielded a reliability index of 0.73. The reliability of the Attitude towards Mathematics Inventory (ATMI) was also tested using Cronbach alpha method. This yielded an alpha of .795, $p < .05$, for the entire Attitude Towards Mathematics Inventory (ATMI). Reliability testing was carried out to establish the internal consistency of the instruments.

800 copies of the instrument were sent to be administered to 800 students (10 in each school). While some schools returned the complete 10 for each instrument, others returned less than 10 copies of each instrument. The total copies that were retrieved back from all the sampled schools were 760, which represent approximately 95% of the total number of administered instruments. Hence, it was 760 copies of the returned instrument that were used for data analysis. The collected data were analyzed using statistical techniques, including correlation analysis and regression analysis. Correlation analysis was conducted to determine the relationship between attitude and mathematical achievement.

Results and Discussion

Research Questions 1: What is the relationship between attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States?

Table 1: Pearson Product Moment Correlation (r) of attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States

Variables	N	Mean	SD	R	r ²	r ^{2adj}	r ² %	Remark
Attitude towards mathematics	760	41.46	14.90	.757 ^a	.574	.573	57.40	Positive relationship
Academic achievement	760	55.49	26.82					

a. Dependent Variable: academic achievement

b. Predictors: (Constant), : attitude towards mathematics

Table 1 shows the Pearson Product Moment Correlation (r) value of .757 as the value of the relationship between attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States. The coefficient of determination (r²) value of 0.574 indicates that students' attitude towards mathematics contributes 57.40% to the variation in the academic achievement of senior secondary school students in Edo and Delta States. Thus, it was concluded that the relationship between attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States is positive.

Research Question 2: What is the relationship between sex and academic achievement of secondary school students in Edo and Delta States?

Table 2: Pearson Product Moment Correlation (r) of attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States

Variables	N	Mean	SD	R	r ²	r ^{2adj}	r ² %	Remark
Sex	760	41.46	14.90	.113 ^a	.013	.011	1.30	Positive relationship
Academic achievement	760	55.49	26.82					

a. Dependent Variable: academic achievement

b. Predictors: (Constant), : sex

Table 2 shows the Pearson Product Moment Correlation (r) value of .113 as the value of the relationship between sex and academic achievement of secondary school students in Edo and Delta States. The coefficient of determination (r²) value of 0.113 indicates that sex contributes 1.30% to the variation in the academic achievement of secondary school students in Edo and Delta States. Thus, it was concluded that the relationship between sex and academic achievement of secondary school students in Edo and Delta States is positive.

Research Question 3: What is the relationship among sex, attitude towards mathematics and mathematics achievement of secondary school students in Edo and Delta States?

Table 3: Multiple Correlation Analysis of Sex, Attitude Towards Mathematics and Mathematics achievement of Secondary School Students in Edo and Delta States

Variables	N	Mean	SD	R	r ²	r ^{2adj}	r ² %	Remark
Sex	760	1.49	.50					
Attitude towards mathematics	760	41.46	14.90	.761	.580	.579	58.00	Positive relationship
Academic achievement	760	55.49	26.82					

Table 3 shows the multiple correlation (r) value of .761 as the value of the relationship among sex, attitude towards mathematics, and academic achievement of secondary school students in Edo and Delta State. The coefficient of determination (r²) value of .580 indicated that sex and attitude towards mathematics jointly contribute 58.00% to the variation in the academic achievement of secondary school students in Edo and Delta States. Thus, it was concluded that the relationship among sex, attitude towards mathematics, and academic achievement of secondary school students in Edo and Delta States is positive.

Testing of Hypotheses

Hypothesis 1: There is no significant relationship between attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States.

Table 4: linear Regression Analysis of the Relationship Between Attitude Towards Mathematics and Academic Achievement of Secondary School Students in Edo and Delta States.

ANOVA ^a					
Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	78298.526	1	78298.526	1019.327	.000 ^b
1 Residual	58224.969	758	76.814		
Total	136523.495	759			

$\alpha = 0.05$

- a. Dependent Variable: academic achievement
- b. Predictors: (Constant), attitude towards mathematics

Table 4 shows a linear regression output of the relationship between attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States. The computed F-value of 1019.327 has a p-value of 0.000. Testing the null hypothesis at an alpha level of 0.05, the p-value of 0.000 was less than the alpha level of 0.05. Therefore, the null hypothesis is rejected. This indicates that there is a significant relationship between attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States.

Hypothesis 2: There is no significant relationship between sex and academic achievement of secondary school students in Edo and Delta States.

Table 5: linear Regression Analysis of the Relationship Between Sex and Mathematics Achievement of Secondary School Students in Edo and Delta States.

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6949.777	1	6949.777	9.771	.002 ^b
	Residual	539144.202	758	711.272		
	Total	546093.979	759			

$\alpha = 0.05$

- a. Dependent Variable: academic achievement
 b. Predictors: (Constant), Sex

Table 5 shows a linear regression output of the relationship between sex and mathematics achievement of secondary school students in Edo and Delta States. The computed F-value of 9.771 has a p-value of 0.002. Testing the null hypothesis at an alpha level of 0.05, the p-value of 0.002 was less than the alpha level of 0.05. Therefore, the null hypothesis was rejected. This indicates that there is a significant relationship between sex and mathematics achievement of secondary school students in Edo and Delta States.

Hypothesis 3: There is no significant relationship among sex, attitude towards mathematics and mathematics achievement of secondary school students in Edo and Delta States.

Table 6: Multiple Regression Analysis of the Relationship among Sex, Attitude Towards Mathematics and Mathematics Achievement of Secondary School Students in Edo and Delta States.

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	79157.541	2	39578.771	522.281	.000 ^b
	Residual	57365.954	757	75.781		
	Total	136523.495	759			

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.559	1.300		-2.738	.006
	Sex	2.129	.632	.079	3.367	.001
	Attitude Towards Mathematics	.678	.021	.754	31.963	.000

$\alpha = 0.05$

- a. Dependent Variable: academic achievement
 b. Predictors: (Constant), sex, Attitude Towards Mathematics

Table 6 shows a multiple regression output of the relationship among sex, attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States. The computed F-value of 522.281 has a p-value of 0.000. Testing the null hypothesis at an alpha level of 0.05, the p-value of 0.000 was less than the alpha level of 0.05. Therefore, the null hypothesis is rejected. This means that there is a significant

relationship among sex, attitude towards mathematics and academic achievement of secondary school students in Edo and Delta States.

Discussion of Findings

The outcome of the data analysis was discussed under the following headings:

Relationship Between Attitude Towards Mathematics and Academic Achievement

Findings from research question one and its corresponding hypothesis show that there is a relationship between attitude towards mathematics and the academic achievement of senior secondary school students in Edo and Delta States. The possible reason for this finding could be that mathematics teachers are beginning to be more aware of the attitude of students towards mathematics, and they are making an effort to provide appropriate support to stimulate the development of a positive attitude towards the subject. This finding agreed with Nicolaidou and Philippou (2013), who found significant correlations between attitudes and achievement. This finding is in line with Kadijevich (2018), who discovered a significant positive relationship between attitude and mathematical achievement. Chen. et al. (2018) also found that students' attitudes towards mathematics have a beneficial impact on their mathematical achievement. Veloo et al. (2015) found that there is a correlation between students' attitudes and their academic achievement. Similarly, Kiwanuka et al. (2020) discovered a statistically significant link between students' attitude and their mathematics achievement.

Relationship between Sex and Mathematics Achievement

Findings from research question two and its corresponding hypothesis show that there is a relationship between sex and mathematics achievement among secondary school students in Edo and Delta States. This finding could be a result of the fact that there is variation in the level of mathematics achievement between male and female students. This finding aligns with Unodiaku (2013), who found that sex influence the mathematical readiness of students. This finding also aligned with Zhuzheng (2017), who found that males and females solve mathematics problems differently.

Relationship among Sex, Attitude Towards Mathematics, and Academic Achievement

Findings from research question three and its corresponding hypothesis show that there is a relationship among sex, attitude towards mathematics, and academic achievement among secondary school students in Edo and Delta States. This finding implies that a combination of sex and attitude towards mathematics go a long way in influencing students' academic achievement in mathematics. This finding also indicates that for children to learn and get good grades in mathematics, they must have a positive attitude towards mathematics. These results align with the findings of Veloo et al. (2015), which indicate a positive link between the attitudes of male and female students and their academic achievement. Individuals of both sexes who possess a favourable disposition towards mathematics are more inclined to achieve high academic scores, while those who have a negative attitude towards mathematics tend to get lower marks. The finding also aligned with Kiwanuka *et al.* (2020), who found a statistically significant link between students' attitude and their mathematics achievement in relation to sex. Manger and Eikeland (2016) indicated that sex differentials have no significant influence on mathematics achievement, but there is a sex difference in characteristics like attitude.

Conclusion

The study examined the correlation among attitude, sex and mathematics achievement in among secondary school students in Edo and Delta States. The finding indicates that attitude significantly correlated with mathematics achievement. The finding also indicates that sex is with academic achievement.

The conclusion therefore is that since attitude towards mathematics significantly correlated with academic achievement. It is obvious that attitude towards mathematics are significant factors influencing academic achievement in mathematics among secondary school students in Edo and Delta States. Hence Students who demonstrated positive attitude towards mathematics tends to score higher on mathematics assessments. Also since sex, and attitude towards mathematics, positively correlated with academic achievement among secondary school students in Edo and Delta States, it was concluded that attitude towards mathematics do not operate in isolation; rather, they interact with sex of students in a way that significantly influences academic achievement.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Mathematics teachers should examine their students' attitude and provide appropriate support to stimulate the development of a positive attitude toward the subject. More practically, teachers could use the survey utilized in the ATMI to examine their students to their level of attitude toward mathematics.
2. Educators, parents, curriculum planners/developers and the society as a whole should discourage students from viewing mathematics as a difficult subject. By doing this, both male and female students would increase and develop a positive attitude toward mathematics.

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