STUDENTS' CHARACTERISTICS AS DETERMINANTS OF ATTITUDE AND PERFORMANCES IN SENIOR SECONDARY SCHOOL MATHEMATICS IN OGUN STATE, NIGERIA: A PATH ANALYTICAL STUDY

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Abstract

Every individual needs mathematical knowledge to transact any business efficiently and effectively in his or her world, though its concepts are difficult to teach and learn. Therefore, this study investigated the students' characteristics as determinant of senior secondary (SSII) attitude and academic performance in Mathematics. Twenty-six senior public secondary schools (SSII) were sampled with fifty students in each school across the entire three senatorial districts of Ogun State and the total number of students involved was one thousand three hundred students. The eight instruments used for data collection were: Mathematics Performance Test, Students' Attitude Towards mathematics Scale, Students' Interest in Mathematics Scale, Students' Peer Influence Scale, Students Study Habit Scale, Students' Motivation Scale, Students Numerical Ability Scale, Students' Learning Style Scale. The study was a descriptive survey type and the data analysis was done with Path Analysis. Findings of the study showed that, there were significant and positive correlations among pairs of the six student variables, the hypothesized model fits the empirical data for attitude towards Mathematics and the hypothesized model fits the empirical data for performance in Mathematics. The study established that the relationship of all the variables to attitude and Mathematics performance has strong correlation. Therefore, it was recommended that there should be regular different inter-school competitions to encourage, motivate and gear-up the students to and be more committed to learning Mathematics as a subject.

Keywords: Students' Characteristics, Attitude and Performances, Correlation to Mathematics.

Introduction

The development of any nation is based on solid educational foundation given to the citizens. This suggests that education provided for the individual should be functional, it should enable a child to develop physically, mentally, socially, emotionally and intellectually. Education can be viewed as key for creating a productive and egalitarian society, therefore, it is necessary that efforts should be geared towards maintaining high standards in schools (Amadioha & Akor, 2018).

The world is speedily becoming a global village and that makes it even more important that all individuals have a better understanding and appreciation of mathematical procedures and methods of reasoning to be carried along. Adedayo (2017) stated that knowledge of Mathematics promotes the habit of accuracy, logical, systematic and orderly arrangements of facts in the individual learner. It also encourages the habit of self- reliance and assists learners to think and solve their problems themselves.

Mathematical knowledge indeed equips individuals with the skill to solve a wide range of practical tasks and problems they may encounter in the society they live in. It is thus essential both to the nation and to the individual that all students receive a quality Mathematics education. Mathematics is so important to the extent that, it is a basic requirement for entry into institutions of higher learning {Functionalised Graphene Nono-sheet (FGN), 2016}. It is regarded as an essential ingredient in the education of every Nigerian child especially in this 21st century.

Every individual also needs mathematical knowledge to transact any business efficiently and effectively in his or her world. Mathematics is one subject that is an integral part of everyone's life and affects virtually every field of human endeavour. An average human being needs mathematics to survive no matter how rudimentary. There is no doubt about the fact that an individual can get on sometimes without knowing how to read and write, but can never push on smoothly without knowing how to count, measure, add and subtract. There are many uses and applications of mathematics in the home, office, in business, in industries, in agriculture, in decision making and even in governance that abound and are innumerable. Usman (2016) noted that in everywhere we go, everything we do or propose to do, either the structure of mathematics or its applications play a crucial role and this is why most countries, races and people put emphasis in all aspects of studying, developing and applying mathematics.

Mathematics is also a body of knowledge essential for the achievement of a scientific/technological nation. Ale (2010) stated that the line of demarcation between the developed and the underdeveloped nations is based on their level of mathematical attainment and ingenuity. Mathematics is an undisputed agent of national development and wealth creation. Confirming this statement, Ohenhen (2018) stated that evidence abound to show that nations that embrace mathematics, science and technology enjoy better standard of living and are less dependent on others.

Mathematics is one of the subjects required at credit level from prospective students for admission into higher institution. It has been observed that students' performance in Mathematics has been consistently below average, especially in the West African Senior School Certificate Examination (WASSCE) organized by the West African Examination Council (WAEC). WASSCE is the external examination taken by Nigerian students at the end of their secondary education and it is one of the examinations used to measure the extent of knowledge, performance and skills the students have

acquired at that level of education. Students' results released yearly by this examination body (WAEC) continue to show a steady trend of poor performance of the students in Mathematics.

Salman (2018) has identified lack of frequent practices, inadequate grasp of Mathematics' technical language, poor mathematical background of the students and influence of parent on the child's career choice as factors affecting performance of students in Mathematics at the secondary school level. Others include incompetent handling of difficult Mathematics topics by teachers, poor pedagogical approach or strategies, non-involvement of learners in practical classroom activities and failure on the part of teachers to relate Mathematics to real life activities.

Many studies such as Karigi (2015), Michael (2015) and Onah (2017), have extensively worked on the factors that are responsible for poor performance in Mathematics but then there are still some areas that are yet to be touched. Much attention has not been given to students' characteristics such as students interest, study habit, peer influence, motivation, learning style and numerical ability as underlying factors that undermine good/or better performance in Mathematics among the students in the schools which these researchers worked upon.

In a path analytical study, Onabamiro (2014) examined principals' factors: teachers' job satisfaction and classroom management and students' performance in senior secondary school Mathematics in south-west, Nigeria. The hypothesised model was trimmed and the new model was found to be tenable in explaining the interaction among principals' factors. Teachers' job satisfaction and classroom management and performance in Mathematics with principals' transformational leadership style and teachers' job satisfaction having the most effective influence on Mathematics performance. The study also revealed that five out of the eleven variables identified have effect on performance in Mathematics. Democratic leadership style, laissez-faire leadership style, transformational leadership style, teachers' job satisfaction and classroom management have direct effect on performance in Mathematics. Others like age, gender, qualification, experience, autocratic leadership style, and principals' supervisory role only have indirect effect.

Similarly, Amusan (2013) examined instructional time, teacher quality and subject area of specialization as determinants of performance in basic science and technology (BST) in Ogun State primary schools, using path analysis. Her results showed that the predictor variables were significantly related to the criterion variables, with estimated direct and indirect effects in the hypothesized model. The findings revealed that school location, pedagogical skills and teachers' attitude to BST as a subject and its teaching, and classroom interactions have significant and predictive influence on pupils' performance in BST. Nevertheless, teacher-pupils classroom interaction was the most potent of the variables which can affect pupils' performance in BST. The study findings established significant relationships between the following: instructional time and school location; gender, subject specialization, instructional time and content knowledge; school location, subject specialization, instructional time, content knowledge and pedagogical skills; gender, subject specialization, content knowledge and attitude; and finally subject specialization, instructional time, content knowledge, pedagogical skills and classroom interactions.

The consistently poor performance of students in Mathematics at senior secondary school level in Nigeria has propelled the researchers to investigate the extent to which students' characteristics (students' interest, study habit, peer influence, motivation, numerical ability, learning style) relate to

and possibly predict students' performance in and attitude towards Mathematics at senior secondary school level in Ogun State, using a path analytical model. This analytical tool enabled the researchers to further estimate the direct, indirect and total effects of the exogenous variables on the endogenous variables in the study.

Statement of the Problem

Reports from an examination body (WAEC) for the past thirteen years (2009-2021) generally indicated poor performance in Mathematics. The thirteen years percentage (mean) of students that obtained A1 to C6 is 49.58% while those that obtained D7 to F9 is 50.42%. This unimpressive performance continues to generate concerns among parents, students, governments and other stakeholders in the education sector. Although many studies have been undertaken on the causes of students' poor academic performance in Mathematics, with the aim of enhancing their performance in the subject, but then there is still need for an improvement in students' performance in the subject. There is an obvious gap known scholarly literature which should be filled.

Besides, among educational scholars and researchers, there are still debates on the extent to which various causal factors could explain variance in students' learning outcomes, particularly in Mathematics at the secondary school level in Nigeria. Furthermore, in most of the previous studies, not much attention has been given to various aspects of students' characteristics; such as students' interest, study habit, peer influence, learning style, numerical abilities and motivation. It is germane to explore how these students' characteristics relate to and predict learning outcomes in Mathematics. Thus, this study keenly focused on examining the extent to which these students' characteristics could possibly determine students' learning outcomes in Mathematics. Therefore, the study examined the predictive abilities of students' interest, study habit, peer influence, learning style, numerical abilities and motivation on Ogun State Senior Secondary students' academic performance in and attitude towards Mathematics.

Research Questions

i What is the pattern of relationships (correlations) in the model consisting of students' interest, study habit, peer influence, motivation, numerical ability, learning style, attitude of students towards Mathematics and their performance in Mathematics in Ogun State secondary schools?

ii. What is the relative contribution of each of the six independent variables to the prediction of attitude towards Mathematics?

iii. What is the relative contribution of each of the six independent variables to the prediction of performances in Mathematics?

Research Design

The study is a descriptive survey type. The researchers collected data from the field so as to determine the extent of relationship and predictive powers of the students' characteristics (independent variables) on attitude and academic performance (dependent variables), without any manipulation of variables in the study (Kelinger & Lee, 2010).

Population of the Study

The population for this study consisted all senior secondary (SSII) students in public educational schools in Ogun State.

Sample and Sampling Techniques
The samples for this study were 1300 SSII students across the three senatorial districts of Ogun State. The multistage sampling technique was used to arrive at the number of students which served as participants. At the preliminary stage, the number of senatorial districts and local government areas in each district were collected for sample selection. The number of secondary schools from each senatorial districts were also collected to represent the first two stages of sampling.

Proportional sampling technique was used to select samples based on the number of schools from each senatorial districts and local government areas at the third stage of sample selection, thus 8, 10 and 8 schools making a total of 26 schools were selected across the three senatorial districts i.e. five percent of the number of senior secondary schools from each senatorial districts was considered. At the fourth stage, the intact classes were used from each selected Senior Secondary Schools. Thus, 400, 500 and 400 SSII students making a total of 1,300 SSII students selected for the study.

Instrumentation
In the study, Mathematics Performance Test (MPT) – (r=0.69) was used. The test (MPT) was constructed and validated by the researchers. The test consisted of 150 items multiple choice with four options. It was designed to measure students' performance in Mathematics. The topics covered the three levels of cognitive objectives namely: knowledge, comprehension and application that were selected from the school curriculum for Senior Secondary (SS2). The data collected were subjected to both descriptive and inferential statistics for the purpose of analysis. Descriptive statistics involved mean and standard deviation scores used to describe the pattern of responses on the independent and dependent variables. Pearson's correlation was used to obtain the correlation matrix used to explain the relationship among the independent and dependent variables at the 0.05 level of significance.

Two multivariate analytical techniques: Multiple regression and Path analysis were also used to help identify the joint effects of the variables, the total, direct and indirect effects of independent variables. Path analysis provided the researchers the opportunity for explicitly exploring the tenability of linkages among the exogenous and endogenous variables of the hypothesized (theoretical) model. The model was developed based on extensive literature review and logical assumption that helped the researchers in tracing the implications of a set of assumptions. The effect of the model was tested using Analysis of Moment Structures (AMOS) version 26.

Results and findings
Research Question 1: What is the pattern of relationships (correlations) in the model consisting students' interest, study habit, peer influence, motivation, numerical ability, learning style, attitude of students towards Mathematics and their performance in Mathematics in Ogun State secondary schools?

Table 1: Correlation Matrix showing Relationship among Students' Interest, study habit, peer influence, motivation, numerical ability, learning style, attitude to, and performance in Mathematics (N = 1300)

Correlations

		L.S X1	N.A X2	Int X4	Mo X3	P.I X5	S.H X6	Att. X7	Pf. X8
L. Style X1	Pearson Correlation	1	.639**	.575**	.584**	.509**	.570**	.618**	.161**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000
N. Ability X2	Pearson Correlation		1	.591**	.688**	.477**	.582**	.690**	.139**
	Sig. (2-tailed)			.000	.000	.000	.000	.000	.000
Interest X4	Pearson Correlation			1	.567**	.502**	.641**	.532**	.161**
	Sig. (2-tailed)				.000	.000	.000	.000	.000
Motivation X3	Pearson Correlation				1	.578**	.562**	.525**	.098**
	Sig. (2-tailed)					.000	.000	.000	.000
Peer Inf X5	Pearson Correlation					1	.551**	.433**	.126**
	Sig. (2-tailed)						.000	.000	.000
S. Habit X6	Pearson Correlation						1	.523**	.141**
	Sig. (2-tailed)							.000	.000
Attitude X7	Pearson Correlation							1	.226**
	Sig. (2-tailed)								.000
Perform X8	Pearson Correlation								1
	Sig. (2-tailed)								

** Correlation is significant at the 0.05 level (2-tailed)

Table 1 shows the result (correlation matrix) of the pair-wise Pearson correlation of the eight variables considered in the study. The result shows that all the twenty-eight possible pairs of correlations are statistically significant. The table shows that students' attitude towards Mathematics correlated significantly with the six students' variables of numerical ability ($r = .690$, $P < .05$), learning style ($r = .618$, $P < .05$), interest ($r = .532$, $P < .05$), motivation ($r = .525$, $P < .05$), study habit ($r = .523$, $P < .05$) and peer influence ($r = .433$, $P < .05$) in that order. The table also shows significant relationship between each of the six student variables and performance in Mathematics in the order of learning style ($r = .161$, $P < .05$), interest ($r = .161$, $P < .05$), study habit ($r = .141$, P

< .05), numerical ability (r = .139, P < .05), peer influence (r = .126, P < .05) and motivation (r = .098, P < .05).

The outcomes thus show that there is significant and positive pair wise relationship between the two criterion variables (attitude and performance in Mathematics) and each of the six student variables investigated in the study (learning style, numerical ability, interest, motivation, study habit and peer influence). The table also shows significant and positive correlations among pairs of the six student variables. In no particular order, these include: Learning style and numerical ability (r = .639, P < .05), learning style and interest (r = .575, P < .05), learning style and motivation (r = .584, P < .05), learning style and study habit (r = .570, P < .05), learning style and peer influence(r = .509, P < .05), numerical ability and interest (r = .591, P < .05), numerical ability and motivation (r = .688, P < .05), numerical ability and study habit (r = .582, P < .05), numerical ability and peer influence (r = .447, P < .05), interest and motivation (r = .567, P < .05), interest and study habit (r = .641, P < .05), interest and peer influence (r = .502, P < .05), motivation and study habit (r = .562, P < .05), motivation and peer influence (r = .578, P < .05) and study habit and peer influence (r = .551, P > .05). These outcomes thus show that, at the .05 level of significance, there exists significant and positive relationship among the pairs of the six student variables considered in the study.

Research Question 2
What is the relative contribution of each of the six independent variables to the prediction?

Table 2: Contribution of each of the Predictor Variables of Attitude towards Mathematics

Model Variable	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
	B	Std. Error	Beta		
(Constant)	9.035	1.734		5.212	.000
Learning Style	.268	.030	.242	8.943	.000*
Numerical Ability	.444	.029	.457	15.466	.000*
Motivation	-.050	.035	-.042	-1.455	.146
Interest	.091	.031	.079	2.912	.004*
Peer Influence	.065	.029	.056	2.233	.026*
Study Habit	.067	.030	.062	2.252	.024*

Dependent Variable: Students' attitude towards Mathematics
*** Indicate significant F at α = .05**

The relative contribution of each variable to the prediction is determined by the standardized beta weight associated with each of the variables. Table 2 shows the standardized beta weights associated with the six independent variables involved in the prediction of students' attitude towards Mathematics. The result shows that five student variables; learning style, numerical ability, interest, peer influence and study habit contributed significantly and meaningfully to the prediction of students' attitude towards Mathematics. Numerical ability has the highest contribution (β = .457, *t* = 15.47), followed by learning style (β = .242, *t* = 8.94), interest (β = .079, *t* = 2.91), study habit (β

= .062, t = 2.25) and peer influence (β = .056, t = 2.23). Motivation with beta weight (β = -.042, t = -1.45, p>.05) has no direct influence on the students' attitude towards mathematics.

Research Question 3
What is the relative contribution of each of the six independent variables to the prediction?

Table 3: Contribution of each of the Predictor Variables to Performance in Mathematics.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Variable	B	Std. Error	Beta		
(Constant)	13.362	2.160		6.185	.000
Learning Style	.081	.037	.085	2.175	.030*
Numerical Ability	.043	.036	.052	1.208	.227
Motivation	-.079	.043	-.078	-1.843	.066
Interest	.085	.039	.085	2.170	.030*
Peer Influence	.049	.036	.048	1.335	.182
Study Habit	.023	.037	.025	.621	.535

Dependent Variable: Students' performance in Mathematics
*** Indicate significant F at α = .05**

The relative contribution of each variable to the prediction is determined by the standardized beta weight associated with each of the variables. Table 3 shows the standardized beta weights associated with the six independent variables involved in the prediction of students' performance in Mathematics. The result shows that only two student variables; learning style and interest contributed significantly and meaningfully to the prediction of students' performance in Mathematics. Learning style (β = .085, t = 2.18) and interest (β = .085, t = 2.17) both recorded the highest contributions to the prediction. The other four independent variables; numerical ability (β = .052, t = 1.21, p>.05), peer influence (β = .048, t = 1.34, p>.05), study habit (β = .025, t = 0.62, p>.05) and motivation (β = -.078, t = -1.84, p>.05) have no direct influence on students' performance in Mathematics.

Conclusions
Based on the findings of this study, this study provided an empirical test of a fit model concerning students' interest, students' study habit, students' peer influence, motivation, learning style, numerical ability, attitude and performance in Mathematics. As relationships, the strength of association from all variables to attitude and Mathematics performance were revealed to have strong correlation. Results also revealed that a large proportion of Mathematics performance can be directly predicted from the attitude towards Mathematics, students' interest, study habit, peer influence, motivation, learning style and numerical ability. Moreover, attitude towards Mathematics, students' interest, students' study habit, peer influence, motivation, learning style and numerical ability influence Mathematics performance directly and indirectly. Hence, if the students build their attitude towards Mathematics, they are more likely to have interest and be motivated in Mathematics which

will positively affect their study habit, learning style, numerical ability and therefore enhance their performance in Mathematics.

Recommendations

The study suggested regular collaboration between the school management, teachers and the parents on how to solve the observed negative attitude of the students. Questionnaire should be made available for all the students periodically where they will express their feelings towards Mathematics. Periodic career guidance counseling sessions should be organized for students on the importance of Mathematics for further education and career pursuit later in life.

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