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Assessment of Gender, Location and Socio-Economic Status on Students' Performance in Senior Secondary Certificate Examination in Mathematics

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Abstract

This study assessed the demographic characteristics of students' performance in Mathematics in senior secondary Certificate Examination in Delta Central Senatorial District of Delta State. The purpose of the study is to assess the relationship between gender, location, socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination. The ex-post facto research design was used for the study. The population of the study is 15,170 SS3. A sample of 759 students was randomly selected from the total population using simple random sampling technique of balloting and stratified random sampling technique. Four research questions and four hypotheses were raised to guide the study. The instrument used for the study was a 40-item multiple choice senior secondary Mathematics Achievement test (SSMAT). Multiple regressions were used for the analysis. The study established that gender and socio-economic status contributed to students' performance in Mathematics in senior secondary certificate examination. Recommendation was made based on the findings of the study.

Keywords: assessment, gender, location, socio-economic status, performance

1. Introduction

Mathematics, as a formal area of teaching and learning, was developed about 5000 years ago by the Sumerians. However, the roots of Mathematics go back much more than 5000 years. Mathematics is the science that deals with the logic of shapes, quantity and arrangement (Hom, 2013). Turnbull, Lea, Parkinson, Phillips, Francis, Webb and Bull (2015) defined Mathematics as the science of numbers and shapes. It involves calculation, computation, measurement, quantity and magnitude. It is exact, precise, systematic and logical. The subject reveals hidden patterns that help us to understand the world around us. Umameh (2011) believes Mathematics helps the individual to understand the environment and to give accurate account of the physical phenomena around every person. Fatima (n. d) sees Mathematics as a science whose subject matter is special forms and qualitative relationships of the real world. A. Udonsa and O. Udonsa (2015) defined Mathematics as the study of qualitative relations or the science of structure, order, numbers, space and relations about counting, measuring, describing of shapes and objects. Branches of Mathematics according to Turnbull et al. (2015) include Arithmetic, Algebra, Geometry, Trigonometry, Calculus and Discrete Mathematics.

The history of modern Mathematics in Nigeria could be traced to the introduction of arithmetic by the European Missionaries into the Nigerian School System. A. Udonsa and O. Udonsa (2015) explains that prior to the advent of the European Missionaries in the country, there was an indigenous system of Mathematics which was expressed in the form of counting and a variety of human experiences was used to promote practice and dexterity in enumeration. With the coming of the missionaries however, the branch of Mathematics called arithmetic was introduced so as to inculcate counting and numeracy skills which were mostly needed to facilitate business transactions and other demands of the age. During the twentieth century, high precedence was given to Mathematics as it became considered to be an important foundation for scientific, technological and economic development of the Nigerian society. Ale (2004) stated unequivocally that a country will find it extremely difficult to produce graduates in the field of engineering, science and technology unless it lays a solid foundation in mathematical science for students of all categories. Salman, Mohammed, Ogunlade and Ayinla (2012) describe Mathematics as the queen and servant of all school subjects, since it cuts across the school curricula. This explains

why Mathematics, as a school subject, affects all aspects of human life, cutting across economics, political science, geography, science and technology etc., as it is centered on the use of numbers, an integral component of every aspect of knowledge. Furthermore, Mathematics is the language used to describe the problems arising in most branches of science and technology. Based on the notion that improved mathematical skill would enhance the development of the country and the quest of realizing the goals and objectives of education in Nigeria, prominence was given to the study of Mathematics in schools in Nigeria as one of the core subjects which must be passed at credit level to gain admission for further studies in any tertiary institution in the science based courses like Mathematics, physics, chemistry, biology, statistics, engineering, economics, medical sciences, to mention but a few. Unfortunately, a lot of Nigerian students of the 21st century have demonstrated little or no enthusiasm towards studying Mathematics, and this is perhaps the reason many students perform poorly in the subject.

Research findings, publications of government and examinations bodies over the years have shown that there is a poor level of Mathematics attainment by students at every level of education in Nigeria, particularly at the Senior Secondary School level (Ajayi, 2002; Nwokocha & Amadike, 2005; Adepoju & Oluchukwu, 2011; Ezeudu & Obi, 2013; Ezeudu, Gbendu, & Umeifekwem, 2014). A review of students' performance in Mathematics in Delta State over the period 2006 - 2012 in Senior Secondary Certificate Examinations (SSCE) conducted by the West African Examinations Council (WAEC) indicate a general unsatisfactory state of affairs, as reflected by the poor performance of students in Mathematics. Statistics published by the Education Resource Centre (2014) of the Delta State Ministry of Basic and Secondary Education shows that only 15.90% of 31,117 (2006), 26.10% of 24,960 (2007), 41.0% of 25,859 (2008), 42.10% of 29,761 (2009), 36.30% of 38,705 (2010), 38.70% of 51,042 (2011) and 49.10% of 56,443 (2012) of the candidates who enrolled for Mathematics in the Senior Secondary Certificate Examination, passed. This level of poor Mathematics performance was the major focus of discussions at the fiftieth Annual Conference of the Mathematical Association of Nigeria (MAN) held in Asaba. The Mathematical Association of Nigeria (2013) identified the possible causes of poor performance in Mathematics to be students, teachers and government related. The Association also identified poor teaching facilities, inadequate and poorly trained teachers, parental laxity, underfunding, gender difference, school location, politics, socio-economic differences, etc., as factors that are affecting students' performance in Mathematics in Nigeria. The MAN emphasised on the need to give attention to the impact demographic characteristics has on students' performance in Mathematics in Senior Secondary Certificate Examination, as a way to reducing the level of poor performance in Mathematics. As a result, the researcher believes there is an urgent need for the assessment of these variables viz-a-viz how they impinge on performance, since situations are not static. The central focus in this study therefore, is the assessment of demographic characteristics of students' performance in Mathematics in Senior Secondary Certificate Examination (SSCE).

1.1 Research Questions

The following research questions guided the study:

(i) What is the relationship between gender, location, socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination?

(ii) What is the relationship between gender and students' performance in Mathematics in Senior Secondary Certificate Examination?

(iii) What is the relationship between location and students' performance in Mathematics in Senior Secondary Certificate Examination?

(iv) What is the relationship between socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination?

1.2 Hypotheses

The following hypotheses were tested at 0.05level of significance.

(i) There is no significant relationship between gender, location, socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination.

(ii) There is no significant relationship between gender and students' performance in Mathematics in Senior Secondary Certificate Examination.

(iii) There is no significant relationship between location and students' performance in Mathematics in Senior Secondary Certificate Examination.

(iv) There is no significant relationship between socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination.

2. Method

The *ex-post facto* research design was employed for the study. Ex-post facto design was used because the researcher's aim was to assess the existing differences in the performance of students in Mathematics in the Senior Secondary Certificate Examination. The population of the study comprised all the 179 Delta State-owned Public Secondary Schools in the Delta Central Senatorial District of Delta State (Delta State Ministry of Education, Asaba), with a total of 56,735 SS students for the 2016 session drawn from both the urban and rural areas of the Senatorial District. Among the 56,735 SS students are a total of 15,170 students who comprised the SS 3 students. The 15,170 SS 3 students are made up of 3,187 males and 3,255 female students from 50 urban schools, and 4,402 males and 4,326 females from 129 rural schools in the Delta Central Senatorial District of Delta State. Out of the total population of 15,170 SS 3 students for the study, 7,589 are males and 7,581 are females from both urban and rural areas respectively across the eight Local Government Areas that constitute the Senatorial District.

A sample size of five percent (5%) of the total population (15,170) of SS 3 students is desired for the study. Five percent of 15,170 equal 759 SS 3 students. This was the total number of students randomly drawn from the 179 state-owned public secondary schools in the Delta Central Senatorial District of Delta State for the study (see Appendix III, for the list of secondary schools in the Senatorial District). The average number of students per school is the population of study (15,170) divided by the number of schools (179) in the Senatorial District. That is 15,170 divided by 179, which gives 85 students approximately, per school. The total number of schools needed for the study equals the sample size (759) divided by the average number of students per school (85). Thus, the number of schools needed for the study is nine (9) schools approximately. Therefore, out of the 179 schools in the area of study, nine were selected through simple random sampling by balloting and stratified random sampling techniques. On the basis of the above, the sample of the study is 759 SS 3 students randomly selected from nine urban and rural secondary schools respectively.

The instrument used for the collection of data for the study is the Senior Secondary Mathematics Achievement Test (SSMAT). The SSMAT is a multiple choice objective test of 40-items adapted from the Senior Secondary Certificate Examination (SSCE) past questions (from 2009 to 2015 academic sessions). This procedure was employed because Osadebe (2015) and Akabogu (2004) posit that past examination questions such as the WAEC conducted SSCE are regarded as standard measures for instructional situations and are generally valid and reliable. The SSMAT instrument covered the content of Mathematics at the knowledge, comprehension, application, analysis, synthesis and evaluation levels of the cognitive domain of the Bloom's taxonomy of education objectives contained in the senior secondary school Mathematics curriculum. The test blue print or table of specification (See Appendix VI) guided the researcher in the compilation of the test items. The SSMAT consisted of two sections, A and B. Section A was demographic data of the respondents. Section B of the instrument is a 40-item multiple choice objective test. There are five options (A, B, C, D, E) for each item made up of one correct answer (key) and four wrong answers (distracters). The respondents were required to tick (√) for the best alternative from A to E that correctly answers the question given in each item.

The validity of the test instrument was established by subjecting the test items to expert screening. Among the experts who screened the test instrument is my research supervisor and two other lecturers in the Department of Guidance and Counselling and in particular, Measurement and Evaluation Unit, to ensure both face and content validity. The estimate of reliability of the Senior Secondary Mathematics Achievement Test (SSMAT) was determined through Kuder Richardson formula 20 ($K - R_{20}$). Copies of the final test were administered to a randomly drawn sample of 30 respondents. Each either passes an item with (1) or fails with (0). The $K - R_{20}$ helped to establish the internal consistency of the Senior Secondary Mathematics Achievement Test. The $K - R_{20}$ correlation coefficient was calculated using IBM SPSS. Thus a reliability estimate of .85 was obtained. This helped to establish the internal consistency of the SSMAT. The details are as shown in Appendix I. On the basis of the results, the test instrument was judged to be reliable.

The list of all the State-owned public Secondary Schools in Delta State Senatorial District was obtained from the Delta State Ministry of Education, Asaba, upon application to the Permanent Secretary (See Appendix III). The researcher personally paid visits to the nine sampled secondary schools used for the study, solicited and obtained permission from the various principals to use their schools for the study (See Appendix IX). The Senior Secondary Mathematics Achievement Test (SSMAT), the instrument for the study, was administered to the 759 SS 3 students sampled from the nine randomly selected secondary schools. The teachers of Mathematics in the sampled schools assisted the researcher in the administration of the instrument in order to avoid any test malpractice. As soon as the administration was completed, the teachers immediately collected the responses from the students and handed over the parcels of completed tests to the researcher under seal for marking and coding.

The data elicited from the field were analysed and presented in tabular format. The scores of the respondents were graded over 40 to determine the Mean (X). On the basis of the mean, the researcher calculated the Standard Deviation (SD) and tested the significance of the performance of gender (male and female), location (urban and rural), and socio-economic status (high and low) on Senior Secondary Certificate Examination in Mathematics. The major statistical technique employed in the study is the standard multiple regression analysis. Coefficient of determination and percentage were used to determine the amount of contribution the independent variables made to the dependent variable, while F-test was used to test the hypotheses at the 0.05 level of significance.

3. Results

Research Questions 1

What is the relationship between gender, location, socio-economic status and students' performance in Mathematics Senior Secondary Certificate Examination?

Table 1. Correlation between gender, location, socioeconomic status and students' performance in Mathematics Senior Secondary School Certificate Examination

Model Summary					
Variables	R	R^2	Adj r^2	SEE	R^2%
Performance (Constant) Gender Location Socio-Economic Status	0.25	0.06	0.06	4.50	6

Table 1 shows the adjusted coefficient of determination (R^2) value as 0.06. This shows that 6% of variance in students' performance in Mathematics in Senior Secondary Certificate Examination is attributed to the collective impact of all three independent variables - gender, location and socio-economic status of the parents of the students.

Research Questions 2

What is the relationship between gender and students' performance in Mathematics Senior Secondary Certificate Examination?

Table 2. Correlation between gender and students' performance in mathematics in senior secondary school certificate examination

Model Summary					
Variable	R	r^2	Adj r^2	See	r^2%
Performance Gender	0.21	0.04	0.04	4.55	4

Table 2 shows the adjusted coefficient of determination (r^2) value as 0.04. This indicates that 4% of variance in students' performance in Mathematics in Senior Secondary Certificate Examination is attributed to the impact of gender. Therefore, gender contributed 4% to the performance of students in Mathematics.

Research Questions 3

What is the relationship between location and students' performance in Mathematics in Senior Secondary Certificate Examination?

Table 3. Correlation between location and students' performance in mathematics in senior secondary school certificate examination

Model Summary					
Variable	R	r^2	Adj r^2	See	r^2%
Performance Location	0.03	0.00	0.00	4.65	0

Table 3 shows the adjusted coefficient of determination (r^2) value as 0.00. This shows that 0% of variance in

students' performance in Mathematics in Senior Secondary Certificate Examination is attributed to the impact of location. Therefore, location contributed 0% to the performance of students in Mathematics.

Research Questions 4

What is the relationship between socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination?

Table 4. Correlation between socio-economic status and students' performance in mathematics in senior secondary school certificate examination

Model Summary					
Variable	R	r^2	Adj r^2	See	r^2%
Performance Socio-Economic Status	0.13	0.02	0.02	4.60	2

Table 4 shows the adjusted coefficient of determination (r^2) value as 0.02. This shows that 2% of variance in students' performance in Mathematics in Senior Secondary Certificate Examination is attributed to the impact of socio-economic status of students' parents. Therefore, socio-economic status contributed 2% to the performance of students in Mathematics.

Hypotheses 1

There is no significant relationship between gender, location, socioeconomic status and students' performance in Senior Secondary Certificate Examination in Mathematics.

Table 5. Regression of gender, location, socio-economic status and students' performance in mathematics in senior secondary school certificate examination

ANOVA					
	SS	Df	MS	F	P
Regression	932.80	3	310.93	15.35	0.00*
Residual	14320.86	707	20.26		
Total	15253.67	710			

Significance: $P < 0.05$.

Table 5 shows that $F(3, 707) = 15.35$, $p < 0.05$. This indicates a statistically significant correlation among gender, location, socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination. The null hypothesis is therefore rejected and the alternative hypothesis, that there is a significant relationship between gender, location, socioeconomic status and students' performance in Mathematics in Senior Secondary Certificate Examination, holds true.

Hypotheses 2

There is no significant relationship between gender and students performance in Mathematics in Senior Secondary Certificate Examination.

Table 6. Regression of gender and student's performance in mathematics in senior secondary school certificate examination

ANOVA					
	SS	Df	MS	F	P
Regression	731.16	1	731.16	35.37	0.00*
Residual	15650.84	757	20.67		
Total	16381.99	758			

Significance: $P < 0.05$.

Table 6 shows that $F(1, 757) = 35.37$, $p < 0.05$. This indicates a statistically significant correlation between gender

and students' performance in Mathematics in Senior Secondary Certificate Examination. The null hypothesis is therefore rejected and the alternative hypothesis, that there is a significant relationship between gender and students performance in Mathematics in Senior Secondary Certificate Examination, holds true.

Hypotheses 3

There is no significant relationship between location and students' performance in Mathematics in Senior Secondary Certificate Examination.

Table 7: Regression of location and students' performance in mathematics in senior Secondary School Certificate Examination

ANOVA					
	SS	Df	MS	F	P
Regression	16.97	1	16.97	0.79	0.38
Residual	16365.03	757	21.62		
Total	16381.99	758			

Significance: $P < 0.05$.

Table 7 shows that $F(1, 757) = 0.79$, $p > 0.05$. This indicates that there is no statistically significant relationship between location and students' performance in Mathematics in Senior Secondary Certificate Examination. The null hypothesis is therefore accepted. This means that the alternative hypotheses, that there is a statistically significant relationship between location and students' performance in Mathematics in Senior Secondary Certificate Examination, does not hold true.

Hypotheses 4

There is no significant relationship between socioeconomic status and students' performance in Mathematics in Senior Secondary Certificate Examination.

Table 8. Regression of socioeconomic status and student's performance in mathematics in senior secondary certificate examination

ANOVA					
	SS	Df	MS	F	P
Regression	250.45	1	250.45	35.37	0.00*
Residual	15003.22	709	21.16		
Total	15253.67	710			

Significance: $P < 0.05$.

Table 8 shows that $F(1, 709) = 35.37$, $p < 0.05$. This indicates that there is a statistically significant relationship between socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination. The null hypothesis is therefore rejected and the alternative hypothesis, that there is a significant relationship between socio-economic status and students' performance in Mathematics in Senior Secondary Certificate Examination, holds true.

4. Discussion

The findings are discussed in relation to the research questions and hypotheses. The findings from the research questions show that gender and socio-economic status have statistically significant effects on students' performance in Senior Secondary Certificate Examination in Mathematics. However, location has no statistically significant effect on students' performance in Mathematics.

The findings on hypotheses 1 revealed that there is a statistically significant relationship between gender, location, socio-economic status and students' performance in Senior Secondary Certificate Examination in Mathematics. This means that students' performance in Senior Secondary Certificate Examination in Mathematics is affected by a combined impact of these variables. This is evident on the Model Summary on Table 5 which shows that 6% of variance in students' performance in Mathematics is due to these variables. This agrees with Alkhadrawi (2015), Owoeye and Yara (2011), and Ghaemi and Yazdanpanah (2014) whose respective studies show that gender,

location and socio-economic status respectively have statistically significant relationship on students' performance in Mathematics.

The findings on hypotheses 2 showed that there is a statistically significant relationship between gender and students' performance in Senior Secondary Certificate Examination in Mathematics. The Model Summary on Table 6 shows that 4% of variance in students' performance in Mathematics was due to the impact of gender. This position agrees with Owoeye and Yara (2011) who posited that gender has a statistically significant relationship with performance and disagrees with Orubu (2007), who posited that gender has no significant relationship with performance in Mathematics.

The results of hypotheses 3 show that there is no statistically significant relationship between location and students' performance in Senior Secondary Certificate Examination in Mathematics. The Model Summary on Table 7 shows that location impacted 0% variance in students' performance in Senior Secondary Certificate Examination in Mathematics. This agrees with Zappala and Considine (2002), Ezeudu (2003), Ezeudu and Obi (2013) as well as Ezeudu et al. (2014), all of whom posit that there is no significant difference between location and students' performance in Mathematics.

The findings of hypotheses 4 show a statistically significant relationship between socio-economic status and students' performance in Senior Secondary Certificate Examination in Mathematics. The Model Summary on Table 8 show that socio-economic status accounts for 2% of variance in students' performance in Senior Secondary Certificate Examination in Mathematics. This finding is in agreement with Orubu (2007) who posited that positive and significant relationships were found to exist between students' parent's income, educational background, family types and performance in Mathematics. The finding also agrees with Ghaemi and Yazdanpanh (2014) who found that socio-economic factors constitute the main cause of inequality of students in schools and other educational systems.

5. Conclusion and Recommendations

This study confirms the view by many experts that gender and socio-economic status of parents impact upon students' performance in Senior Secondary Certificate Examination in Mathematics. However, the findings contradict the view that performance in Senior Secondary Certificate Examination is influenced by the location of the student. Although the findings of the study particularly relate to the Delta Central Senatorial District of Delta State, they could be referred to in judging students' performance in Senior Secondary Certificate Examination in Mathematics in other parts of Delta State.

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

1) Students, irrespective of their gender should be equally encouraged to study Mathematics since it is basic for making progress in every area of life.
2) Parents should make concerted effort to improve on their socio-economic status by diversifying their sources of income so as to be able to meet the required financial pressure of training their children through Senior Secondary School.

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