

SSCE and UTME as Correlates of Undergraduate Students' Academic Achievement in Mathematics

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ABSTRACT

This study determined students' SSCE grades and UTME scores in Mathematics as correlates of the first year mean achievement scores of the students in undergraduate Mathematics. The study used correlational research design. It was carried out in Ebonyi State and was guided by three research questions, and three hypotheses. The study used a sample of 120 students out of the population of 146 students drawn from the 2014/2015, 2015/2016, and 2016/2017 academic sessions in both the Pure and Applied Mathematics and Mathematics Education courses using both purposive sampling and proportionate random sampling techniques. The data were collected using the researcher-made instrument which was face validated by three specialists in Measurement and Evaluation and one in Mathematics Education. The data were analysed using Multiple Linear Regression. The findings of the study showed a low positive relationship between students' SSCE grades and the students' achievement; and a moderate positive relationship between students' UTME scores and the first year mean achievement scores.

Keywords: Correlational research design, undergraduate students, mathematics education, achievement test

INTRODUCTION

The measures of students' academic achievement have always been determined through examinations. This implies that examination has been an integral part of western education in Nigeria since its inception in 1842. Okobia (2015) noted that the purpose of any test (or examination) is to determine the quality that the testees have that would help to make useful decisions that will affect the people exposed to it. Such decisions can be in terms of promotion from one level of education to another, placement into appropriate classes, making prediction about the inherent potentials of the students or learners, certification, and even for employment. Such all important decisions can only be achieved with instruments that possess the psychometric qualities of validity, reliability and consistency. Afemikhe (2007) opined that quality of education is important to Nigeria as the products are expected to service the economy. The author added that quality is necessary to be gauged as quality school graduates can be a source of capital inflow. The need to ensure quality and standard in the measurement of the academic achievement of the students especially at the Senior Secondary School level led to the establishment of examination bodies such as West African Examination Council (WAEC) and the National Examination Council (NECO) to take charge of the Senior School Certificate Examination (SSCE); and the Joint Admissions and Matriculation Board (JAMB) to take care of the Unified Tertiary Matriculation Examination (UTME).

WAEC is a West African sub-regional examination body established in Nigeria in 1952. The ordinance that established WAEC was first enacted in Ghana in 1951 and later in Nigeria, Sierra Leone, and Gambia in 1952 (Nworgu, 2015). WAEC was solely in charge of SSCE in Nigeria until 1999 when NECO was established. Today, WAEC and NECO are responsible for the conduct of SSCE in Nigeria. One of the qualifications for seeking admission to study any course including Mathematics in any tertiary institution in Nigeria is the possession of five credits pass in SSCE in the relevant subjects including English Language and Mathematics. Such candidate will also be required to seat for and attain the cut off mark in the Unified Tertiary Matriculation Examination (UTME) conducted by JAMB. UTME is a selection examination written by candidates seeking

for admission into the Nigeria institutions of higher learning (Ituma, 2021). It is an aptitude test which helps to reveal the candidates' potentials in relation to their desired courses of study. JAMB is an examination body legally established by an Act (No. 2 of 1978) and subsequently amended by Decree No. 33 of 1989 to conduct matriculation examinations for entry into all universities, Polytechnics and Colleges of Education in Nigeria (JAMB, 2017).

From the year 2000, there has been the issue of falling standard of education in Nigeria. This has largely been attributed to the issue of examination malpractices among other things. Emaikwu (2015) noted that one major challenge facing the use of selection examination for placement into tertiary institutions in Nigeria is the scourge of examination malpractice. The author added that examination malpractices have consistently remained a bane of Nigerian educational system.

The examination bodies have adopted some measures to curb this ugly trend. Both WAEC and NECO have on several occasions blacklisted some examination supervisors who were found to have been involved in examination malpractices and were banned from supervising such examination. Also, many secondary schools have been blacklisted across the country for their alleged involvement in examination malpractice and such schools were made to pay huge fines before they were allowed to register candidates again for the West Africa Senior School Certificate Examination (WASSCE). For instance, in 2021, WAEC blacklisted 165 secondary schools in Kwara state for their alleged involvement in examination malpractices and threatened heavy sanctions on the school heads or officials caught aiding and abetting examination malpractices in the state (Adebayo, 2021). Similarly, in 2024, WAEC blacklisted some schools in Abia state over examination malpractices with the commissioner for education threatening to withdraw the operational licenses of such schools which she said were mostly private schools (Agberebi, 2024). JAMB has resorted to the use of Computer Based Test (CBT) among other measures as a way of controlling the ugly situation. Afemikhe (2007) noted that the belief that education is an avenue to acquire the good things of life has manifested itself in massive examination malpractice. The author further noted that as examination agencies try to reduce the scourge, the more determined the perpetrators are at devising out ingenious methods. Hence, there have been doubts as to whether SSCE and UTME still have the capacity to predict students' academic achievement in the University especially in undergraduate Mathematics.

There have been some studies on the predictive validity of SSCE and UTME. The finding of the study carried out by Farayola (2014) showed a low positive relationship between SSCE and Vectorial Mechanics (MAT 102, a first year second semester course in Emmanuel Alayande College of Education, Oyo, Oyo State). However, the achievement of the students in Vectorial Mechanics which is a single course was not good enough to represent the achievement of the students in undergraduate Mathematics. Also, Afu & Ukofia (2017) investigated the predictive validity of West African Senior School Certificate Examination (WASSCE) and National Examination Council's Senior School Certificate Examination (NECO-SSCE) results on 100 level students' cumulative grade point average (CGPA) in University of Abuja. The study used a sample of 720 undergraduates drawn from the four faculties and departments of the institution using purposive sampling technique. The findings of the study showed that using WASSCE students' results to predict 100 level examinations for the four departments of English Language, Economics, Education and Accounting from 2008/2009 to 2010/2011 academic sessions indicated moderate positive correlation coefficient for English Language and Education departments in 2008/2009 academic year, with negative correlation coefficient for all the departments in 2009/2010 to 2010/2011 academic sessions. Also, using NECO as the predictor of 100 level students' performance revealed that only English department in 2008/2009 showed moderate positive relationship, with the rest of the departments showing negative relationships in 2008/2009 to 2010/2011 sessions. But this study did not investigate the undergraduate students' achievement in Mathematics.

Kpe-Nobana & Wonu (2019) investigated the extent public examinations (WASSCE, UTME & Post-UTME) predicted performance on university Algebra among undergraduate students of the department of computer science, Ignatius Ajuru University of Education, Port Harcourt, Nigeria. The study used a sample of 67 students of all the year one computer science students of the 2012/2013 session who took FSC 114 (Algebra) in the 1st semester examination. The findings among other things established that the three public examinations significantly predicted university Algebra performance of the students respectively. The result established that WASSCE had the strongest predictive power when compared with UTME and Post-UTME. Olawe & Abioye

(2013) carried out a study on the predictive validity of UTME scores on the final degree results of university students in Nigeria. The study used a sample of 71 graduates drawn from the population of all the students admitted into Osun State University through the UTME conducted in 2007 and graduated in May, 2011. The data collected were analysed using Pearson correlation coefficient and the result showed a negative low correlation coefficient of -0.093.

The findings of the above studies further created doubts as to whether SSCE and UTME still have the capacity to predict students' academic achievement in undergraduate Mathematics. Ituma (2021) observed that some of the undergraduate Mathematics students who attained high grades in SSCE Mathematics and high scores in UTME Mathematics end up spending extra years in the university. Some of the students end up having many carry overs in their first-year courses which make it difficult for them to go into second year. Some of these students are placed-on probation, while some may decide to change their courses or drop out of school. Meanwhile, (Ajogbeje & Borisade, 2012) opined that high performance in SSCE and UTME as measures of the candidates' previous background knowledge in the same subject matter ought to serve as pre-requisites to the intended course of study. Hence, the need for this study to determine the relationship between students' SSCE grades, UTME scores and the students' academic achievement in undergraduate Mathematics.

The general purpose of this study was to determine SSCE and UTME scores as correlates of students' academic achievement in undergraduate Mathematics.

Research Questions

The study was guided by the following research questions:

- i. What is the relationship between students' SSCE grades in Mathematics and their first year mean achievement scores in undergraduate Mathematics?
- ii. What is the relationship between students' UTME scores in Mathematics and their first year mean achievement scores in undergraduate Mathematics?
- iii. What is the joint multiple relationship between the independent variables (SSCE grades and UTME scores in Mathematics) and the dependent variable (students' mean achievement scores in undergraduate Mathematics)?

Hypotheses

This study was guided by the following hypotheses which were tested at 0.05 level of significance.

- H₀₁: There is no significant relationship between students' SSCE grades in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics.
- H₀₂: There is no significant relationship between students' UTME scores in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics.
- H₀₃: There is no significant joint multiple relationship between the independent variables and the dependent variable.

METHOD

The design of the study was correlational research design. The study was carried out in Ebonyi State using the two universities namely, Ebonyi State University (EBSU) Abakaliki and Alex Ekwueme Federal University Ndufu Alike Ikwo (AE-FUNAI). The study used a sample of 120 students out of the total population of 146 students drawn from the 2014/2015, 2015/2016, and 2016/2017 academic sessions in both the Pure and Applied Mathematics courses and Mathematics Education course using both purposive sampling and proportionate random sampling techniques. Purposive sampling technique was used on the criteria that any student for the study must have written Mathematics examinations in both SSCE and UTME. Also, the student

must have written both the first and second semester Mathematics courses in the first year of the 2014/2015, 2015/2016 or in the 2016/2017 academic session.

Proportionate random sampling technique was used to draw the said sample of 120 students from the two institutions (EBSU and AE-FUNAI) and the courses (Pure and Applied Mathematics courses and Mathematics Education courses). This was done to take care of the unequal number of students admitted in both universities and courses of studies as well as the three academic sessions involved in the study. The data were collected using the researcher-made instrument titled “Entry Characteristics and Academic Achievement Proforma”. The instrument was face validated by three specialists in Measurement and Evaluation, and one from Mathematics Education. A checklist was used to ensure that it was only those who met the required criteria were included in the study.

The data were analysed using Multiple Linear Regression. Research questions i and ii were answered using the Pearson correlation coefficients, while research question iii was answered using Regression Analysis. All the hypotheses were tested at 0.05 levels of significance using exact probability approach. The decision rule was to reject the null hypothesis H_0 , if the exact probability is less than the a priori probability of 0.05 level of significance. Analysis of Variance (ANOVA) was used to determine the significance of the multiple correlation coefficient, R. Coefficients of determination were used to determine the amount of variations in the dependent variable that were attributed to the independent variables. The correlation coefficients were interpreted following the benchmark provided in the 3-way guide for interpreting correlation coefficient (r) by Downie & Heath (1975). It provided that the correlation coefficient, r of 0.3 and below is interpreted as low; above 0.3 and below 0.8 as moderate; and 0.8 and above interpreted as high. The students’ SSCE grades were converted to real scores using the WAEC grading system updated September 11, 2017 and obtained from the WAEC website. The mid-score for the interpreted range of scores for each of the SSCE grades was computed by the researchers. From the grading system, A1 is interpreted as 80% -100% with a mid-score of 90%; B2 is interpreted as 70% - 79% with a mid-score of 74.5%; B3 is interpreted as 65% - 69% with a mid-score of 67%; C4 was interpreted as 60% - 64% with a mid-score of 62; etc. The UTME scores were directly used as raw scores in the analysis. Whereas, the students’ mean scores in the first year Mathematics courses were computed by the researcher and were used as the students’ achievement in undergraduate Mathematics

RESULTS

Table 1: A Correlation Table Showing the Relationship between Students’ SSCE Grades in Mathematics and the First Year Mean Achievement Scores of the Students in Undergraduate Mathematics

Variables	\bar{X}	SD	N	R	r^2	Sig.	Decision
SSCE Grades in Mathematics	59.82	8.06	120	.174	.030	.029	Rejected
Mean Achievement Scores	56.91	11.94	120				
$p < .05$, $r^2 = \text{Coefficient of determination}$							

The result in **Table 1** above shows a correlation coefficient (r) of .174(i.e. $r = .174$) between the students’ SSCE grades in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics. The Table also shows a coefficient of determination of .03(i.e. $r^2 = .030$) between the two variables. Hence, following the Downie and Heath (1975)’s 3-way guide for the interpretation of the correlation coefficient r, there is low positive relationship between the students’ SSCE grades in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics. Also, the students’ SSCE grades in Mathematics accounts for only 3.0% of the total variations in the students’ academic achievement in undergraduate Mathematics.

The result in **Table 1** above shows an obtained significant value of .029 as against the a priori probability of 0.05 level of significance. Hence, since the obtained exact probability of .029 is less than the a priori probability of 0.05 level of significance, the hypothesis 1 (H_{01}) above is rejected. Therefore, there is

significant relationship between the students' SSCE grades in Mathematics and the students' first year mean achievement scores in undergraduate Mathematics.

Table 2: A Correlation Table Showing the Relationship between Students' UTME Scores in Mathematics and the First Year Mean Achievement Scores of the Students in Undergraduate Mathematics

Variables	\bar{X}	SD	N	R	r^2	Sig.	Decision
UTME Scores in Mathematics	51.02	6.75	120	.554	.307	.000	Rejected
Mean Achievement Scores	56.91	11.94	120				
$p < .05, \quad r^2 = \text{Coefficient of determination}$							

The result in **table 2** above shows a correlation coefficient of .554 (i.e. $r = .554$) and a coefficient of determination of .307 (i.e. $r^2 = .307$). Hence, there is a moderate positive relationship between the students' UTME scores in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics courses. Also, the students' UTME scores in Mathematics accounted for 30.7% of the total variations in the students' achievement in undergraduate Mathematics.

The result in **Table 2** above shows an obtained significant value of .000 for the relationship between the students' UTME scores in Mathematics and the students' first year mean achievement scores in undergraduate Mathematics courses. This is against the a priori probability of 0.05 level of significance. Hence, since the obtained exact probability of .000 is less than the a priori probability of 0.05 level of significance, the hypothesis 2 (H_{02}) above is rejected. Therefore, there is a significant relationship between the students' UTME scores in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics courses.

Table 3: A Correlation Table Showing the Multiple Correlation (R) between the Independent(Predictor) Variables and the dependent Variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.558 ^a	.312	.300	9.993
<i>a. Predictors: (Constant), UTME Score in Maths, SSCE Grade in Maths</i>				
<i>b. Dependent Variable: Achievement in First Year Maths</i>				

The result in **Table 3** above shows a multiple correlation coefficient R of .558 (i.e. $R = .558$) between the independent variables and the dependent variable; and a coefficient of determination R^2 of .312 (i.e. $R^2 = .312$). Hence, there is a moderate positive relationship between the independent variables and the dependent variable. Also, the independent variables jointly accounted for 31.2% of the total variations in the dependent variable.

Table 4: A Table showing the significant or otherwise of the multiple correlation coefficient (R)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5292.060	2	2646.030	26.497	.000 ^b
	Residual	11683.931	117	99.863		
	Total	16975.992	119			

a. *Dependent Variable: Achievement in First Year Mathematics*

b. *Predictors: (Constant), SSCE Grade in Maths, UTME Score in Mathematics*

The result in **Table 4** above shows that the multiple correlation coefficient R, between the predictor variables and the dependent variable is significant at .000. This significant value of .000 is against the a priori probability of 0.05 level of significance. Therefore, since the obtained exact probability of .000 is less than the a priori probability of 0.05 level of significance, the hypothesis 3 (H₀₃) above is rejected. Hence, there is a significant relationship between the independent (predictor) variables (i.e. students' SSCE grade in Mathematics and students' UTME scores in Mathematics) and the dependent variable (i.e. first year mean achievement scores of the students in undergraduate Mathematics courses).

The analysis further showed that the regression model or equation for predicting the first year mean achievement scores of the students in undergraduate Mathematics from their SSCE Mathematics grades and UTME Mathematics scores is:

$$\hat{Y} = 1.848 + 0.105X_1 + 0.957X_2$$

Where \hat{Y} = Predicted first year mean achievement score of a student in undergraduate Mathematics; X_1 = student's SSCE grade in Mathematics; and X_2 = student's UTME score in Mathematics. Whereas 0.105 and 0.957 are the regression weights for SSCE and UTME respectively.

DISCUSSION

The findings of this study revealed a low positive relationship between the students' SSCE grades in Mathematics and the mean achievement scores of the students in first year undergraduate Mathematics. The issue with this finding is that of low positive relationship. Although, this relationship is significant, SSCE explained only 3.0% of the total variation in the mean achievement scores of the students in undergraduate Mathematics. This points out to the fact that examination malpractice is still rearing its ugly head in the SSCE conducted by both WAEC and NECO. This finding is in agreement with the findings of the study carried out by Obioma and Salau (2007) which showed a weak positive relationship between SSCE grades and the first and final year Cumulative Grade Point Average (CGPA) of undergraduate students in Nigeria. The same apply to the study of Farayola (2014) which showed a low positive relationship between SSCE and Vectorial Mechanics.

In the light of the above findings, the issue of consistent low or weak positive relationship between SSCE and the academic achievement of undergraduate students is a thing of major concern that need to be addressed. This is so because, although the result of this study showed a positive relationship between students' SSCE grades in Mathematics and the first year mean achievement of the students in undergraduate Mathematics, SSCE accounted for only 3.0% of the total variations in the mean achievement of the students in undergraduate Mathematics.

The findings also revealed a moderate positive relationship between UTME scores in Mathematics and first year mean achievement scores of the students in undergraduate Mathematics. The result of the study showed that UTME scores in Mathematics significantly positively correlated with the first year mean achievement scores of the students in undergraduate Mathematics courses. And that UTME accounted for 30.7% of the total variation in the mean achievement scores of the students in undergraduate Mathematics. The findings of this study are strong indications that UTME can validly predict students' achievement in undergraduate Mathematics. The findings of this study agree with the finding of the study carried out by Osakuade (2015), in which UTME significantly correlated with the final grades of the undergraduate students. However, the findings of this study disagree with the findings of the study carried out by Obioma & Salau (2007), Farayola (2014), Okobia (2015), each of which UTME failed to correlate significantly with the first year CGPA of the undergraduate students. The reason for the disagreement could be that Obioma & Salau, Farayola, and Okobia may have carried out the studies as at the time when JAMB had not adopted the recent innovations in the

conduct of UTME. Therefore, the improvement in the significant correlation between students' UTME scores in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics as in this study may be attributed to the recent innovations in the conduct of Unified Tertiary Matriculation Examination (UTME). In other words, one may say that the introduction of Computer Based Test (CBT) among other innovations by JAMB in the conduct of UTME is a step in the right direction.

CONCLUSIONS

In view of the findings and the discussion of the findings above, the researchers hereby conclude that SSCE grades in Mathematics are not reliable predictors of students' academic achievement in undergraduate Mathematics. In other words, that a student scored high grade in SSCE Mathematics is not a guarantee that the same student will achieve highly in undergraduate Mathematics. Also, the researchers concluded that UTME scores in Mathematics are reliable predictors of students' achievement in undergraduate Mathematics. In all, the researchers concluded that students' UTME scores in Mathematics is the best single predictor of the students' achievement in undergraduate Mathematics. Therefore, the combination of SSCE grades in Mathematics and UTME scores in Mathematics with higher weight attached to UTME is a more reliable way to predict students' achievement in undergraduate Mathematics.

In view of research question i, this study has shown that a low positive relationship (i.e. $r = .174$) exists between the students' SSCE grades in Mathematics and the first year mean achievement scores of the students in undergraduate Mathematics. Also, that the students' SSCE grades in Mathematics accounted for only 3.0% of the total variations in the students' academic achievement in undergraduate Mathematics. For research question ii, a moderate positive relationship (i.e. $r = .554$) exists between UTME scores in Mathematics and first year mean achievement scores of the students in undergraduate Mathematics. The UTME accounted for 30.7% of the total variation in the mean achievement scores of the students in undergraduate Mathematics. As for the research question iii, a moderate multiple joint relationship (i.e. $R = .558$) exists between the independent variables and the dependent variable, with the independent variables jointly accounting for 31.2% of the total variations in the dependent variable.

Implications

One of the implications of the findings of this study is that the cognitive structures formed by some or many of the students as a result of their experiences in Secondary School Mathematics were unorganized or badly connected with the new experiences of the students in undergraduate Mathematics. Hence, resulting to poor academic achievement of such students in undergraduate Mathematics; spending of extra years in the university; having references in some courses; graduating with low class of degrees; applying for change of course after being admitted; and some being placed on probation or withdrawn after the first-year examination; etc. Hence, by implication, the findings of this study have helped to strengthen both the Piaget (1952) Cognitive Constructivist Theory and Ausubel (1980) Assimilation Theory of Learning.

Practically, the findings of this study have some implications on the government as policy makers, the examination bodies, the university authorities, parents or guardians, teachers, and the students.

Another implication of the findings of this study is that the SSCE conducted by both WAEC and NECO is not a reliable instrument for predicting the academic achievement of the students in undergraduate Mathematics. It points out to the fact that SSCE conducted by WAEC and NECO is associated with a very high degree of examination malpractice. The students, teachers, parents or guardians and examination officials should know that any act of aiding or abating examination malpractice is an immoral act punishable not just by law but by God. By implication, the parents or teachers are not doing any good to the students by encouraging them to be involved in the act of examination malpractice.

RECOMMENDATIONS

In line with the findings of this study, the researchers made the following recommendations.

1. Government at all levels should critically examine the issue of teaching and learning of Mathematics in both the Basic and Post-Basic levels of education in Nigeria with a view of bringing about improvement in the relationship between students' SSCE grades in Mathematics and the academic achievement of the students in undergraduate Mathematics.
2. The examination bodies such as WAEC and NECO should seat up to the challenges of examination malpractice by bringing about innovations that will reduce the scourge of examination malpractice to the barest minimum, such as adoption of CBT for the multiple-choice examinations among other measures.

Limitation of the Study

The study was carried out in one State (Ebonyi State) out of the 36 states of the federation including the Federal Capital Territory (FCT). The result of the study may have been different if samples were drawn at least from the six geo-political zones of the federation.

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