PREDICTIVE VALIDITY OF MATHEMATICS AND INTEGRATED SCIENCE JUNIOR SECONDARY SCHOOL CERTIFICATE EXAMINATIONS ON STUDENTS' ACHIEVEMENT IN SENIOR SECONDARY SCHOOLS BIOLOGY IN ONDO STATE, NIGERIA

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Abstract
The study examined the predictive validity of Junior Secondary School Certificate Mathematics and Integrated Science examinations on academic performance of Senior Secondary School Biology students in Ondo State. Three research hypotheses were generated to guide the study. The study employed expost-facto research design. Thirty-six secondary schools were purposively selected from six Local Government Areas of the three Senatorial Districts in Ondo State, namely, Ondo North, Ondo Central and Ondo South. Two Local Government Areas were selected from each of the Senatorial Districts using simple random sampling technique. A total of 1,826 from the entire 2020/2021 SSS3 Biology students that came in by JSSCE and had complete record from SSS1 to SSS3 and also sat for Biology in SSS classes and 2020/2021 WAEC/NECO SSCE were involved in the selected secondary schools. Data collected were analyzed using correlation analysis and regression analysis. All the results revealed that JSSC Mathematics examinations and JSSC Integrated Science examinations significantly predict academic performance of students at the SSS2 unified examination in Biology; WAEC SSC examinations in Biology; and NECO SSC examinations in Biology. Based on the findings of this study, it was therefore recommended among others, that JSSCE results should remain a yardstick for admitting Biology students into senior secondary schools as a way of achieving and maintaining quality Biology education.

Keywords: Academic, Correlation, Predictive, Performance, Validity

Introduction

The Junior Secondary School Certificate Examination (JSSCE) is a public examination in Nigeria, conducted by each State of the Federation through their respective Ministries of Education for final year students of the Junior Secondary School (JSS) at the end of the third year of Junior Secondary Schooling. The National Examination Council (NECO) is a national examination body responsible for the conduct of JSSCE to all JSS3 students of the Federal Government Colleges and some Private Secondary Schools in Nigeria who are willing to register their students for NECO examinations. The JSSCE is the system adopted in admitting students to

senior secondary schools and the admission is controlled by the various States' Ministries of Education in Nigeria.

The unified examination is the examination conducted by Ministries of Education for senior secondary school two (SSS2) at the end of third term in Ondo State. Results of this examination serve as promotion examination to SSS3. While the senior secondary school certificate examination (SSSCE) on the other hand is a national examination for all Senior Secondary School three (SSS3) students in all secondary schools in Nigeria. It is being conducted and administered by West African Examinations' Council (WAEC) and National Examinations' Council (NECO). The two examination agencies conduct parallel or equivalent Senior Certificate Examinations in the country. The WASCE was first conducted in 1958 by WAEC and its validity has been ascertained by many researchers like Ojerinde (1986), WAEC (1994) and Olagbde (2019).

The academic performance of students depends to a great extent on certain factors. These factors include type of school attended, sex and age (Ojerinde, 1986; Usomona, 1993; Akintade, 1994; Adedara, 1998; Adelana, 2001 Ogunboyede, 2017). There is considerable research evidence to show that previous knowledge will affect academic performance (Akintade, 1994; Jolade, 2002; Kolawole, 2002; Oladunni and Obaisi, 2003; Adelana, 2005; Adeyemi, 2008; Ogunboyede, 2013). This is perhaps, one of the major reasons for the adoption of JSSCE as a yardstick for admitting students to senior secondary schools in Nigeria. Hence, a student is admitted with the assumption that he or she possesses the ability and skills necessary to cope with the academic challenges at the Senior Secondary School level (SSS).

However, despite the unique position of examinations in educational system, there have been conflicting reports on the predictive strength of the JSSCE at predicting performance in the senior secondary school examinations (Ondo State Ministry of Education, 2001, Omorojo, 2001, Oladugba, 2002, Asaoye, 2003 and Adeyemi, 2008). Some educational researchers such as Adelana (2001) and Sylvester (2007), have advocated for the cancellation of the junior secondary school certificate examinations on the ground that its predictive value is in doubt.

The above inconsistent reports and findings leave one with doubt as to whether JSSCE may have reliable validity. It is therefore necessary in this study to examine the predictive validity of the JSSC Mathematics and Integrated Science examinations. The study was designed to examine the validity of Junior Secondary School Certificate Mathematics and Integrated Science Examinations for predicting Biology students' academic performance in senior secondary schools in Ondo State.
The study was specifically designed to examine:

a. Predictive strength of JSSC Mathematics examination scores and JSSC Integrated Science examination scores on academic performance of students at the SSS2 unified Biology examination.
b. Predictive strength o JSSC Mathematics examination scores and JSSC Integrated Science examination scores on academic performance of students at NECO SSC Biology examination.

c. Predictive strength of JSSC Mathematics examination scores and JSSC Integrated Science examination scores on academic performance of students at WAEC SSC Biology examination.

Research Hypotheses

The following hypotheses were generated to guide the study:

H_{o1}. JSSC Mathematics examination scores and JSSC Integrated Science examination scores will not significantly predict academic performance of students at the SSS2 unified Biology examinations.

H_{o2}. JSSC Mathematics examination scores and JSSC Integrated Science examination scores will not significantly predict academic performance of students at the WAEC SSC Biology examinations.

H_{o3}. JSSC Mathematics examination scores and JSSC Integrated Science examination scores will not significantly predict academic performance of students at the NECO SSC Biology examinations.

Methodology

The study is a descriptive research of the expost-facto research design. The target population consisted of the entire 2020/2021 SSS3 students that were admitted into senior secondary schools through JSSCE results. The sample for the study comprised of 1,826 SSS3 Biology students selected through multistage sampling technique. The selected Biology students were the students that wrote Mathematics and Integrated Science in JSSCE, offered Biology as a subject at the senior secondary school level and wrote 2020/2021 WAEC/NECO SSCE. These constituted the subjects for the study. The geographical areas of Ondo State were stratified into three Senatorial Districts, namely; Ondo North, Ondo Central and Ondo South, using stratified sampling technique. A simple random sampling technique was then used to select two local Government Areas from each of the Senatorial Districts. Six secondary schools from each of the selected Local Government Areas were then selected using purposive random sampling technique. These schools were purposively selected because they are the top six oldest secondary schools from each of the selected Local Government Areas and have been presenting students for WASCE and NECO for over 20 years. Therefore, they are expected to have well-equipped laboratories and libraries for effective teaching and learning of Integrated Science, Mathematics and Biology. Hence, their choice for the study.

An inventory titled “Students JSSCE and SSSE Academic Performance Proforma" was used to collect the relevant data for the study. The Proforma consisted of items that captured information about the students such as name of school, Local Government Area, students' JSSCE scores in Mathematics and Integrated Science for 2016/2017, the students' scores in Biology for 2019/2020 unified examinations and 2020/2021 SSC examinations. The pattern of grading students' scores in JSSCE are such that the distinction grade is represented by “A” (60 – 100). The credit grade

is represented by "c" (50 – 59). The ordinary pass is represented by "P" (40 – 49) while the failure grade is represented by "F" (0 – 39). The pattern of grading students' scores in senior secondary school examinations (internal and external) are such that the distinction grade is represented by B3 to A1(65 – 100). The credit grade is represented by C6 to C4 (50 – 64). The ordinary pass grade is represented by E8 to D7 (40 – 49) and the failure grade is represented by F9 (0 – 39). For the purpose of scoring, therefore, JSSCE grades of A, C, P and F were awarded 3, 2, 1 and 0 points respectively while SSE grades of (B3 - A1), (C4 – C6), (D7 – E8) and F9 were also awarded 3, 2, 1 and 0 points respectively.

The researchers used the proforma in each of the selected schools to collect students' grades in Mathematics and Integrated Science for 2016/2017 JSSCE, as well as students' grades in Biology for 2019/2020 SSS2 unified examinations and 2020/2021 SSC examinations. Data collected were analyzed using correlation analysis and regression analysis. All the null hypotheses postulated for the study were tested at 0.05 level of significance.

Results

Hypothesis One: JSSC Mathematics examination scores, and JSSC Integrated science examination scores, will not significantly predict academic performance of students at the SSS2 unified Biology examinations.

Table 1: Regression analysis SSS2 unified Biology examination results as criterion.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Beta	Constant
1. JSSCS	0.125	0.016	0.015	0.360	0.125	1.697
2. JSSCMTH	0.175	0.031	0.029	0.358	0.069	2.079

Dependent variable: UNIBIO

Table 2: Summary of ANOVA of the goodness of fit of the regression equation.

Model	Sum of squares	d f	Mean squares	F	Sig
1. JSSCS					
Regression	3.777	1	3.777	29.085	.000
Residual	236.895	1824	.130		
Total	240.673	1825			
2. JSSCMTH					
Regression	7.360	2	2.453	19.158	.000
Residual	233.313	1823	.128		
Total	240.693	1825			

P < 0.05, significant results
Predictors (constant), JSSCS
Predictors (constant), JSSCS, JSSCMTH
Dependent variable: UNIBIO

Table 1 shows that in SSS2 unified Biology examinations, JSSC Integrated Science examinations predicted 1.6% of the variance, while the JSSC Mathematics examinations predicted 3.1% of the variance. Beta values shows that JSSC Integrated Science examination results and JSSC Mathematics examination results had negligible predictive strength for SSS2 unified Biology examinations.

From table 2, the F calculated were significant at 0.05 level of significance. Thus, the null hypothesis that states that JSSC Mathematics examination scores and JSSC Integrated science examination scores would not significantly predict academic performance of students at the SSS2 unified Biology examinations was therefore rejected. This means that JSSC Mathematics examination scores and JSSC Integrated science examination scores significantly predicted academic performance of students at the SSS2 unified Biology examinations.

Hypothesis Two: JSSC mathematics examination scores and JSSC Integrated Science examination scores will not significantly predict academic performance of students at the **WAEC** SSC Biology examinations

Table 3: Regression analysis: WAEC SSC Biology examination results as criterion.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Beta	Constant
1. JSSCS	0.371	0.137	0.137	0.532	0.371	0.759
2. JSSCMTH	0.424	0.180	0.179	0.519	0.210	0.308

Dependent variable: WAEC BIO

Table 4: Summary of ANOVA of the goodness of fit of the regression equation.

Model	Sum of squares	df	Mean squares	F	Sig.
1. JSSCS					
Regression	82.157	1	82.157	290.428	.000
Residual	515.979	1824	.283		
Total	598.136	1825			
2. JSSCMTH					
Regression	107.740	2	53.870	200.256	.000
Residual	490.396	1823	.269		
Total	598.136	1825			

$P < 0.05$, significant results

Predictors: (constant), JSSCS

Predictors: (constant), JSSCS, JSSCMTH

Dependent: variable: WAECBIO

Table 3 shows that in WAEC SSC Biology examinations, the JSSC Integrated Science examinations predicted 13.7% of the variance while JSSC Mathematics examinations accounted for 18% of the variance. Beta values shows that JSSC Integrated science examination results and JSSC Mathematics examinations results had low predictive strength for WAEC SSC Biology examinations.

In table 4, the F calculated were significant at 0.05 level of significance. Thus the null hypothesis that states that JSSC Mathematics examination scores and JSSC Integrated science examination scores would not significantly predict academic performance of students at the WAECSSC Biology examinations was therefore rejected. This means that JSSC Mathematics examination scores and JSSC Integrated science examination scores significantly predicted academic performance of students at the WAEC SSC Biology examinations.

H_{o3}. JSSC Mathematics examination scores and JSSC Integrated Science examination scores will not significantly predict academic performance of students at the **NECO** SSC Biology examinations.

Table 5: Regression analysis NECO SSC Biology examination results as criterion.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Beta	Constant
1. JSSCMTH	0.167	0.028	0.028	0.603	0.167	1.449
2. JSSCS	0.184	0.034	0.033	0.602	0.078	1.259

Dependent variable: NECOBIO

Table 6: Summary of ANOVA of the goodness of fit of the regression equation.

Model	Sum of squares	df	Mean squares	F	Sig
1. JSSCMTH					
Regression	19.149	1	19.149	52.627	.000
Residual	663.693	1824	.364		
Total	682.842	1825			
2. JSSCS					
Regression	23.166	2	11.583	32.009	.000
Residual	659.676	1823	.362		
Total	682.842	1825			

$P < 0.05$, significant results
Predictors: (constant), JSSCMTH
Predictors: (constant), JSSCMTH, JSSCS
Dependent variable: NECOBIO

Table 5 shows that in NECO SSC Biology examinations, JSSC Mathematics examinations predicted 2.8% of the variance while the JSSC Integrated Science examinations predicted 3.4% of the variance. Beta values shows that JSSC Mathematics examination results and JSSC Integrated Science examination results had negligible predictive strengths for NECO SSC Biology examinations.

In table 6, the F calculated were significant at 0.05 level of significance. Thus the null hypothesis that states that JSSC Mathematics examination scores and JSSC Integrated science examination scores would not significantly predict academic performance of students at the NECO SSC Biology examinations was therefore rejected. This means that JSSC Mathematics examination scores and JSSC

Integrated science examination scores significantly predicted academic performance of students at the NECO SSC Biology examinations.

Discussion of Findings

Findings from the study reveals that the academic performances of students in the JSSC Mathematics examinations and JSSC Integrated Science examinations were significant predictors of the academic performance of students in the SSS2 unified Biology examinations. This was in contrary to the findings made by Omorojo (2001), who reported that the JSSC Mathematics and Integrated Science examinations could not predict the academic performance of students at the SSC Biology examination.

It was also reveal from the study that academic performances of students in the JSSC Mathematics examinations and JSSC Integrated Science examinations were Significant predictors of the academic performance of students at the WAEC and NECO SSC Biology examinations. This was in consonance with the findings made by Oladugba (2002), who reported that the JSSC Mathematics examinations and JSSC Integrated Science examinations were significant predictors of the academic performance of students at the SSC Biology examinations. However, this is at variance with the findings of Adeyemi (2008), who claimed that JSSC Mathematics examinations was not a significant predictor of students' performance at the SSC Biology examinations and found no significant relationship between the performance of students in the JSSC Integrated Science and the SSC Biology examinations.

Conclusion

Based on the findings of the study, it was concluded that the academic performance of Biology students in the JSSC Mathematics examinations and JSSC Integrated Science examinations were low predictors of the academic performance of Biology students at SSS2 unified examinations, NECO and WAEC SSC examinations. However, the low prediction was significant.

Recommendations

Based on the findings of this study, the following recommendations are made for improvement:

- ❖ The JSSCE results should remain as a yardstick for admitting Biology students into senior secondary schools as a way of achieving and maintaining good quality Biology education.
- ❖ Parents and teachers should also provide the much-needed conducive atmosphere to learn Mathematics, Integrated Science and Biology among others subjects.
- ❖ Teachers, students, parents and guardians should get fully prepared for the challenges of Mathematics and Integrated Science so that the students could do well in SSS2 unified Biology examinations and SSC Biology examinations conducted by WAEC and NECO

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