JUNIOR SCHOOL CERTIFICATE RESULTS IN MATHEMATICS AND BASIC SCIENCE AS PREDICTORS OF STUDENTS' PERFORMANCE IN SENIOR SECONDARY SCHOOL PHYSICS EXAMINATIONS IN ONDO STATE

BY

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Abstract

The study investigated the junior school certificate results in Mathematics and Basic science as predictors of students' performance in senior secondary school Physics examination in Ondo State. Four research hypotheses were generated for the study. The hypotheses were tested at 0.05 level of significance. 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 Physics students who came in by JSCE and had complete record from SSS1 to SSS3 and also sat for Physics 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. Result revealed that Mathematics and Basic science JSCE results significantly predict students' performance at the SSS2 unified examinations in Physics ($F = 91.639$, $P < 0.05$), WAEC SSC examinations in Physics ($F = 220.297$, $P < 0.05$), and NECO SSC examinations in Physics ($F = 66.478$, $P < 0.05$). It was concluded that JSC mathematics and Basic science examination results would significantly predict the academic performance of students at the SSS 2 unified, WAECSSC and NECOSSC Physics examinations. Based on the findings of this study, it was recommended among others, that JSCE results should remain a yardstick for admitting students into senior secondary schools as a way of achieving and maintaining quality Physics education.

Keywords: *Performance, Correlation, JSCE, Basic science, Physics.*

Introduction

The academic performance of students depends to a great extent on certain factors. These factors include type of school attended, sex and age (Ogunboyede, 2017; Olatunde 2017; Robert; 2019; Adelana, 2020; Ojuola, 2021). Researchers showed that previous knowledge affects academic performance (Ogunwole, 2016; James, 2018; Ololade, 2019; Obiano, 2020; Wilson and Thompson, 2020; Akinola, 2021 Ojuola, 2021). This is, one of the major reasons for the adoption of JSCE as a yardstick for admitting students to senior secondary schools in Nigeria (Wilson and Thompson, 2020). 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.

The Junior School Certificate Examination (JSCE) is a public examination in Nigeria, conducted by each State of the Federation through their respective Ministries of Education for students 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 JSCE for 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 JSCE 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 the Ministries of Education for senior secondary school two (SSS2) at the end of third term in Ondo State. The results of this examination serve as a promotion examination to SSS3. While the Senior School Certificate Examination (SSCE) 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 boards conduct parallel or equivalent Senior School Certificate (SSC) Examinations in the country. The WASCE was first conducted in 1958 by WAEC and its validity has been ascertained by many researchers like Olatunde (2017) and Olagbade (2019).

According to Ojelade (2019), when scores on a test can be appreciably used to predict or estimate learners performance on another test, the test used for prediction, the predictor, is said to have predictive validity, while the second test that was predicted is referred to as criterion. Omodara (2020) said that predictive validity is the ability of an instrument to predict some future event (s). Predictive validity is the extent to which a test predicts success in future when candidates are selected into study programs in Nigeria schools on the basis of their JSCE. The belief behind this selection process is that students who meet the admission requirements will likely succeed in their studies. However, how accurate this belief actually is remains uncertain.

If an examination existed that could a accurately forecast a student's future performance with minimal mistakes, admission committees in schools would have dependable tools to choose candidates most likely to excel in their academic pursuits. But unfortunately, most current tests of performance do not possess such quality (Agenta, 2016). Predictive validity, within this context demands that for any test of performance to be used as an index of later performance in a school, it must be fully established that the test scores are capable of forecasting degree of success in the proposed area of study. In other words, for the test scores to be used as predictors of future academic performance, there must be a significant relationship between such score and later performance or some criterion.

Mathematics is as old as man. It has developed from the time when there was often little practical use of what was studied to its present position as the basis on which our scientific and technical knowledge built. The importance of mathematics cannot be overstressed as it is the base of all science. All students must learn and pass it at the secondary school level before they can be admitted into the university (Olofin and Kolawole, 2020).

Basic science is one of the subjects offered at the junior secondary level. The essence of teaching basic science at junior secondary level in Nigeria secondary education is to prepare students for the science subjects so that each of the major science subjects, that is, physics, chemistry and biology will not be totally new to the students at the senior secondary level. Basic science as a subject is therefore a perquisite to subject like physics, chemistry and biology. Sciences are very important in the development of a nation. The development of a country rest on

science and technology in the world of work (Nwakie, 2018). All students must learn and pass Mathematics and Basic science at the junior secondary school level before they can be admitted to learn Physics at the senior secondary schools (Nwaogozie, 2022).

Physics is one of the science subjects in the secondary school curriculum in Nigeria. The subject is offered at the senior secondary school level Oriola (2019) observed that Physics is needed to produce the necessary human resource and skilled labour force to manage our local industries and educational institutions. The study of Physics helps us to understand our natural world and also approach challenges we face in life and our work place in a more systematic and logical manner. Physics education is the conscious effort to raise the level of scientific of all students and equip them with relevant basic scientific knowledge needed for their own living and also contribute to the country development (Olusola, 2022).

Despite the unique position of examinations in educational system, there have been conflicting reports on the predictive strength of the JSCE at predicting performance in the senior secondary school examinations (Ondo State Ministry of Education, 2016, Gideon, 2016; Olusola, 2020; Daniel, 2020 and Ojuola, 2021). Based on that concern, some educational researchers have advocated for the review of the junior school certificate examinations on the ground that its predictive value is in doubt (e.g. Donald, 2017 Olagbade 2019 Zainab, 2022). For example Donald (2017) examined the predictive validity of Oyo State junior secondary certificate examination. The study was undertaken to find out whether there is significant relationship between the overall performance of students in the JSCE and their performance in the senior school certificate examination (SSCE). Scores of students in JSCE and scores of students in SSCE were correlated using correlation analysis procedure. Overall performance in JSCE across the six subjects of which Mathematics, Basic science and Physics were included showed no significant relationship between the subjects. It was recommended that JSCE must be reviewed. He therefore advocated for the review of JSCE on the ground that its predictive value is in doubt.

Adebayo (2018) examined the predictive validity of JSC examination scores in selected public and private secondary schools in Abeokuta, Ogun State. Scores of 40 students in Mathematics and Basic science at 2010 and 2011 were run against their scores in 2013 and 2014 Physics in Abeokuta. The JSCE results in Mathematics and Integrated science were run against SSC examination results in Physics using person product moment correlation to determine the relationship. Result revealed that JSCE Mathematics and Basic science examinations were not significant predictor of the performance of students in SSC physics examination. The result also showed no significant relationship between students' performance in the overall JSC examinations and SSC examinations. The researcher had correlated JSC Mathematics and Integrated science in the SSC Physics examinations. The above inconsistent reports and findings leave one with doubt as to whether JSCE may have reliable validity. It is therefore necessary to examine the predictive validity of the Junior School Certificate (JSC) Mathematics and Basic science examinations in Ondo state.

The study was designed to examine the junior school certificate results in Mathematics (JSCMTH) and junior school certificate Basic science (JSCS) as predictors of student's performance in senior secondary school Physics examinations in Ondo state. The study was specifically designed to:

a) examine the relationship among the academic performance of

students in JSC Mathematics, JSC Basic science, SSS2 unified Physics, WAECSSC Physics and NECOSSC Physics examination results.

b) determine the values of JSC Mathematics and Basic science examination results in predicting subsequent results in SSS2 Physics examinations.
c) determine the values of JSC Mathematics and Basic science examination results in predicting subsequent results in WAECSSC Physics examinations.
d) determine the values of JSC Mathematics and Basic science examination results in predicting subsequent results in NECOSSC Physics examinations.

Research Hypotheses

The following hypotheses were generated for the study:

H_{01}. There is no significant relationship among the academic performance of students in JSC Mathematics, JSC Basic science, SSS 2 unified Physics, WAECSSC Physics and NECO SSC Physics examination results.

H_{02}. JSC Mathematics and JSC Basic science examination results will not significantly predict the academic performance of students at the SSS2 unified Physics examinations.

H_{03}. JSC Mathematics and JSC Basic science examination results will not significantly predict the academic performance of students at the WAEC SSC Physics examinations.

H_{04}. JSC Mathematics and JSC Basic science examination results will not significantly predict academic performance of students at the NECO SSC Physics examinations.

Methodology

The study was a descriptive research of the expost-facto research design as the researcher did not have direct control on the independent variables, their manifestation has already occurred. (Ngokie (2020). They were inherently not manipulable. The data were collected from the examination result sheets sent to schools by the Ondo State Ministry of Education known as JSCE Computer sheet and master marks' sheet records in the schools

The target population consisted of the entire 2020/2021 SSS3 students who were admitted into senior secondary schools through JSCE results in Ondo State. The sample for the study comprised of 1,826 SSS3 Physics students selected through multistage sampling technique. The selected Physics students were the students who wrote Mathematics and Basic science in JSCE, offered as a subject at the senior secondary school level and wrote 2020/2021 WAEC/NECO SSCE. These constituted the subjects for the study. First 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 (LGAs) out of six 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 LGAs and have been presenting students for WASCE and NECO for over 20 years. Therefore, they were expected to have well-equipped laboratories and libraries for effective teaching and learning of Basic science, Mathematics and Physics.

An inventory titled "Students JSCE and senior secondary school examination (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' JSCE grades in Mathematics and Basic science for 2017/2018, the students' grades in Physics 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) Fadotun, (2020). For the purpose of scoring, therefore, JSCE grades of A, C, P and F were awarded 3, 2, 1 and 0 points respectively while SSSE grades of (B3 - A1), (C4 – C6), (D7 – E8) and F9 were also awarded 3, 2, 1 and 0 points respectively (see table 1).

The data collected were analyzed using correlation analysis and regression analysis. These analyses were chosen as focus was placed on association relationship indicating the strength, direction of relationship as well as prediction (Nwakie, 2018). All the null hypotheses postulated for the study were tested at 0.05 level of significance.

Table 1: Pattern of Grading Students in JSCE Mathematics and Basic science and SSS 3 Physics.

Examination	Grade	Scores Range	Scoring Point
JSCE Mathematics and Basic science	A	60 – 100	3
	C	50 – 59	2
	P	40 – 49	1
	F	0 – 39	0
SSSE Physics	A	65 – 100	3
	C	50 – 64	2
	P	40 – 49	1
	F	0 – 39	0

Results and Discussion

Testing of Hypotheses

$H0_1$: There is no significant relationship among the academic performance of students in JSC Mathematics, JSC Basic science, SSS2 unified Physics, WAECSSC Physics and NECO SSC Physics examination results.

Table 2: Correlation matrix showing relationship among the academic performance of students in JSC Mathematics, JSC Basic science, SSS2 unified Physics, WAECSSC Physics and NECOSSC Physics examination results.

Variables	JSCE Mathematics	JSCE Basic Science	SSS2 unified Examination Physics	WAECSSC Physics	NECOSSC Physics
JSCE Mathematics	1				
JSCE Basic Science	0.482 P = 0.000	1			
SSS2 Unified Examination Physics	0.648 P = 0.000	0.568 P = 0.000	1		
WAECSSC Physics	0.689 P = 0.000	0.743 P = 0.000	0.631 P = 0.000	1	
NECOSSC Physics	0.674 P = 0.000	0.685 P = 0.000	0.494 P = 0.000	0.812 P = 0.000	1

Table 2 presented the relationship among the academic performance of students in JSC Mathematics, JSC Basic science, SSS2 unified Physics, WAECSSC Physics and NECOSSC Physics examination results. The result showed that there was positive significant relationship between JSC Mathematics and SSS2 unified Physics examination results ($r = 0.648$, $P < 0.05$), JSC Basic science examination result had a positive significant relationship with SSS2 unified Physics examination results ($r = 0.568$, $P < 0.05$). The results revealed that JSC Mathematics examination results had positive significant relationship with WAECSSC Physics examination results ($r = 0.743$, $P < 0.05$), JSC Basic science examination result had a positive significant relationship with WAECSSC Physics examination result. ($r = 0.631$, $p < 0.05$). The table also revealed a positive significant relationship between JSC Mathematics and NECOSSC Physics examination results ($r = 0.674$, $P < 0.05$), a positive significant relationship was established between JSC Basic science and NECOSSC Physics examination results ($r = 0.685$, $P < 0.05$). By implication, the hypothesis was rejected since independent variables significant correlate with dependent variable at 0.05 level of significance in each case.

H_{02}: JSC Mathematics and JSC Basic science examination results will not significantly predict the academic performance of students at the SSS2 unified Physics examinations.

Table 3: Summary of regression analysis of the academic performance of students in JSC Mathematics and JSC Basic science examination results with the SSS 2 unified Physics examinations results

$R = 0.645$ $R^2 = 0.416$ Adjusted $R^2 = 0.414$	Sum of squares	df	Mean square	F	Sig.
Regression	296.651	2	148.326	99.481	0.000
Residual	2718.907	1823	1.491		
Total	3015.558	1825			

$P < 0.05$, significant results
Dependent variable: UNIPHY

Predictors (constant), JSCMTH, JSCS

The results in table 3 showed the academic performance of students in JSC Mathematics and JSC Basic science on SSS2 unified Physics examination results (F = 99.481, P < 0.05). Thus, the hypothesis 2 was rejected. The result revealed that there was positive correlation between the academic performance of students in JSC Mathematics, JSC Basic science and SSS2 unified Physics examination results. (R = 0.645, P < 0.05). The value of the coefficient of determination (R^2 = 0.416) indicated that the predictor variables jointly accounted for 41.6% of the variance in criterion

H_{03}: JSC Mathematics and JSC Basic science examination results will not significantly predict the academic performance of students at the WAECSSC Physics examinations.

Table 4: Summary of regression analysis of the academic performance of students in JSC Mathematics and JSC Basic science examination results with the WAECSSC Physics examination results

R = 0.718 R^2 = 0.516 Adjusted R^2 = 0.513	Sum of squares	df	Mean square	F	Sig.
Regression	739.914	2	369.957	170.017	0.000
Residual	4986.728	1823	2.176		
Total	5726.642	1825			

P < 0.05, significant results
Dependent variable: WAEC PHY
Predictors (constant), JSCMTH, JSCS

The result in table 4 showed the academic performance of students in JSC Mathematics and JSC Basic science on WAECSSC Physics examination results (F = 170.017, P < 0.05). Thus, the hypothesis 3 was rejected. The result showed that there was positive correlation between the academic performance of students in JSC Mathematics, JSC Basic science and WAECSSC Physics examinations results (R = 0.718, P < 0.05). The value of the coefficient of determination (R^2 = 0.516), indicated that the predictor variables jointly accounted for 51.6% of the variance in WAECSSC Physics examinations.

H04: JSC Mathematics and JSC I Basic science examination results will not significantly predict the academic performance of students at the NECO SSC Physics examinations.

Table 5: Summary of regression analysis of the academic performance of Students in JSC Mathematics and JSC Basic science examination results with the NECO SSC Physics examination results.

R = 0.684 R^2 = 0.468 Adjusted R^2 = 0.466	Sum of Squares	df	Mean square	F	Sig.
Regression	229.876	2	114.938	84.825	0.000
Residual	2471.328	1823	1.355		
Total	2701.204	1825			

P < 0.05, Significant results
Dependent variable: NECO PHY
Predictors (constant), JSCMTH, JSCS

The results in table 5 showed the academic performance of students in JSC Mathematics and JSC Basic science on NECO SSC Physics

examination results (F = 84.825, P< 0.05). Therefore, the hypothesis 4 was rejected. The result showed that there was positive correlation between the academic performance of students in JSC Mathematics JSC Basic Science and NECO SSC Physics examination results (R = 0.684, P < 0.05). The value of the coefficient of determination (R^2 = 0.468) indicated that the predictor variables jointly accounted for 46.8% of the variance in NECOSSC Physics examinations.

Discussion of the Findings

Finding from hypothesis 1 revealed that there was significant relationship among the academic performance of students in JSC Mathematics, JSC Basic science, SSS2 unified Physics, WAECSSC Physics and NECOSSC Physics examination results. The finding was not in consonance with the findings of Donald (2017) and Raymond (2018) who found no significant relationship between the JSC Mathematics, JSC Basic science and SSC Physics examination results.

Finding from hypothesis 2 revealed that the academic performances of students in the JSC Mathematics examinations and JSC Basic science examinations were significant predictors of the academic performance of students in the SSS2 unified Physics examinations. This was in contrary to the findings made by Gideon (2016) and Adebayo (2018) who reported that the JSC Mathematics and Basic science examinations could not predict the academic performance of students at the SSC Physics examinations.

Finding from hypotheses 3 and 4 revealed that academic performances of students in the JSC Mathematics examinations and JSC Basic science examinations were significant predictors of the academic performance of students at the WAEC and NECO SSC Physics examinations. This was in agreement with the finding of Ojuola (2021), who reported that the JSC Mathematics examinations and JSC Basic science examinations were significant predictors of the academic performance of students at the SSC Physics examinations. However, this was at variance with the findings of Akinola (2021), who claimed that JSC Mathematics examinations was not a significant predictor of students' performance at the SSC Physics examinations and found no significant relationship between the performance of students in the JSC Basic science and the SSC Physics examinations.

The JSCE is a yardstick for admitting students into the SSS in Ondo State. The student who is hereby selected must have possessed the abilities and skills necessary to cope effectively with the academic challenges/rigours in the SSS, since such a student would have acquired and completed the contents of the JSS curriculum. A student who performs brilliantly in the JSCE in Mathematics and Basic science should have the ability to cope and perform brilliantly in the SSS2 unified examinations and SSCE in Physics. All things been equal, a student with good results in Mathematics and Basic science JSCE should also obtain the same grades in SSS2 unified examinations and SSCE in Physics.

Conclusion

Based on the findings of the study, it was concluded that JSC Mathematics and Basic science examination results would significantly predict the academic performance of students at the SSS2 unified, WAECSSC and NECOSSC Physics examinations.

Recommendations

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

1. The JSCE results should remain as a yardstick for admitting Physics students into senior

secondary schools as a way of achieving and maintaining good quality Physics education.

2. Parents should divest themselves of illusion that the grades obtained by their words in Basic science is an authentic indicator of the grades they would have at senior secondary school Physics. They should rather get their wards properly equipped to face the greater task that lies ahead in Physics. This could take the form of procuring relevant textbooks in Physics.

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