

**PREDICTIVE VALIDITY OF JUNIOR SCHOOL CERTIFICATE MATHEMATICS  
AND INTEGRATED SCIENCE EXAMINATIONS ON ACADEMIC  
PERFORMANCE OF SENIOR SECONDARY SCHOOL CHEMISTRY STUDENTS  
IN ONDO STATE, NIGERIA**

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**Abstract**

The study examined the Predictive Validity of Junior School Certificate Mathematics and Integrated Science Examinations on Academic Performance of Senior Secondary School Chemistry Students in Ondo State. Four objectives and hypotheses were generated to guide the study. Thirty-six secondary schools were purposively. A total of 1,826 from the entire 2020/2021 SSS3 Chemistry students who came in by JSCE and had complete record from SSS1 to SSS3 and also sat for Chemistry in SSS classes and 2020/2021 WAEC/NECO SSCE were involved in the selected secondary schools. An inventory titled “Students JSCE and senior secondary school examination (SSSE) Academic Performance Proforma” was used to collect the relevant data for the study. Data collected were analyzed using correlation analysis and regression analysis. Findings revealed that JSC Mathematics and Integrated science examinations significantly predict academic performance of students at the SSS2 unified examinations in Chemistry ( $F = 91.639, P < 0.05$ ), WAEC examinations in Chemistry (220.297,  $P < 0.05$ ), and NECO examinations in chemistry (66.478,  $P < 0.05$ ). 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 Chemistry education.

**Keywords:** Predictive Validity, JSCE, Academic Performance.

**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; & Oyinola, 2021). Besides these factors, here is also a considerable research evidence to show that previous knowledge affects academic performance (Ogunwole, 2016; James, 2018; Ololade, 2019; Obiano, 2020; Wilson and Thompson, 2020; Akinola, 2021 & Oyinola, 2021). This is perhaps, 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 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 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).

Talking about performance examination brings to mind predictive validity that is the forecasting effectiveness of the examination. According to Ojelade (2019), when scores on a test can be appreciably used to predict or estimate students' performance on another test, the test used for prediction, 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. 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 predictive validity comes into play. The assumption in such selection is the meeting the admission criteria by entrants predicts their subsequent success in their studies. The extent to which this is really so is the problem.

If there were to be an examination such that the current performance of an examinee in it can predict his/her later performance with minimum error, the admission committee of various schools; would be well equipped with reliable tools for selecting candidates that are likely to succeed in their future academic endeavors. But unfortunately, most current tests of performance do not possess such quality (Agentia, 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 advance to university (Olofin & Kolawole, 2020). Integrated science is one of the subjects

offered at the junior secondary level. The essence of teaching integrated 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 science secondary level. Chemistry as one of the sciences has a fundamental role in advancing the frontiers of scientific knowledge in providing a solid footing for technological super structure, which is now a burning aspiration of the country.

### **Statement of the problem**

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; Ojuola, 2018; Olusola, 2020 & Daniel, 2020). Based on that concern, some educational researchers have advocated for the cancellation of the junior school certificate examinations on the ground that its predictive value is in doubt (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, Integrated Science and Chemistry were included showed no significant relationship between the subjects. It was recommended that JSCE must be cancelled. He therefore advocated for the cancellation 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 Integrated 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 Integrated 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 Integrated Science examinations.

### **Objectives of the Study**

The study was designed to examine the predictive validity of Junior School Certificate Mathematics (JSC MTH) and Junior School Certificate Integrated Science (JSCS) examinations on the academic performance of senior secondary school Chemistry students in Ondo state. The study was specifically designed to:

- a) examine the relationship in the academic performance of students in JSC Mathematics, JSC Integrated science, SSS2 unified Chemistry, WAEC Chemistry and NECO Chemistry examination results.
- b) determine the values of JSC Mathematics and Integrated science examination grades in predicting subsequent grades of students in SSS2 unified Chemistry examinations.
- c) determine the values of JSC Mathematics and Integrated Science examination grades in predicting subsequent grades of students in WAEC Chemistry examinations.
- d) determine the values of JSC Mathematics and Integrated science examination grades in predicting subsequent grades of students in NECO Chemistry examinations.

### **Hypotheses**

The following hypotheses were generated for the study:

H<sub>01</sub>. There is no significant relationship in the academic performance of students in JSC Mathematics, JSC Integrated science, SSS 2 unified Chemistry, WAEC Chemistry and NECO Chemistry examination results.

H<sub>02</sub>. JSC Mathematics and JSC Integrated Science examination grades will not significantly predict the academic performance of students at the SSS2 unified Chemistry examinations.

H<sub>03</sub>. JSC Mathematics and JSC Integrated Science examination grades will not significantly predict the academic performance of students at the WAEC Chemistry examinations.

H<sub>04</sub>. JSC Mathematics and JSC Integrated Science examination grades will not significantly predict academic performance of students at the NECO Chemistry examinations.

### **Methodology**

The study was a descriptive research of the ex-post-facto research design as the researcher did not have direct control on the independent variables, their manifestation has already occurred (Nwanne, 2013). 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 Chemistry students selected through multistage sampling technique. The selected Chemistry students were the students who wrote Mathematics and Integrated Science in JSCE, offered Chemistry 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 Integrated Science, Mathematics and Chemistry.

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 Integrated Science for 2017/2018, the students’ grades in Chemistry for 2019/2020 unified examinations and 2020/2021 SSC examinations. The pattern of grading students’ grades 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, 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.

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 (Nwokie, 2016). All the null hypotheses postulated for the study were tested at 0.05 level of significance.

## Results

**H0<sub>1</sub>:** There is no significant relationship among the academic performance of students in JSC Mathematics, JSC Integrated science, SSS2 unified Chemistry, WAECSSC Chemistry and NECO SSC Chemistry examination results.

**Table 1: Correlation matrix showing relationship among the academic performance of students in JSC Mathematics, JSC Integrated science, SSS2 unified Chemistry, WAECSSC Chemistry and NECOSSC Chemistry examination results.**

| Variables               | JSCE Mathematics | JSCE Integrated Science | SSS2 unified Examination Chemistry | WAECSSC Chemistry | NECOSSC Chemistry |
|-------------------------|------------------|-------------------------|------------------------------------|-------------------|-------------------|
| JSCE Mathematics        | 1                |                         |                                    |                   |                   |
| JSCE Integrated Science | 0.461            | 1                       |                                    |                   |                   |

|   |           |           |           |           |   |
|---|-----------|-----------|-----------|-----------|---|
|   | P = 0.000 |           |           |           |   |
| <b>SSS2 Unified Examination Chemistry</b> | 0.523     | 0.498     | 1         |           |   |
|   | P = 0.000 | P = 0.000 |           |           |   |
| <b>WAECCSSC Chemistry</b>                 | 0.514     | 0.622     | 0.553     | 1         |   |
|   | P = 0.000 | P = 0.000 | P = 0.000 |           |   |
| <b>NECOSSC Chemistry</b>                  | 0.496     | 0.548     | 0.489     | 0.721     | 1 |
|   | P = 0.000 | P = 0.000 | P = 0.000 | P = 0.000 |   |

Table 1 presented the relationship among the academic performance of students in JSC Mathematics, JSC Integrated science, SSS2 unified Chemistry, WAECCSSC Chemistry and NECOSSC Chemistry examination results. The result showed that there was positive significant relationship between JSC Mathematics and SSS2 unified Chemistry examination results ( $r = 0.523, P < 0.05$ ), JSC Integrated science examination result had a positive significant relationship with SSS2 unified Chemistry examination results ( $r = 0.498, P < 0.05$ ). The results revealed that JSC Mathematics examination results had positive significant relationship with WAECCSSC Chemistry examination results ( $r = 0.514, P < 0.05$ ), JSC Integrated science examination result had a positive significant relationship with WAECCSSC Chemistry examination result. ( $r = 0.622, p < 0.05$ ). The table also revealed a positive significant relationship between JSC Mathematics and NECOSSC Chemistry examination results ( $r = 0.496, P < 0.05$ ), a positive significant relationship was established between JSC Integrated science and NECOSSC Chemistry examination results ( $r = 0.548, P < 0.05$ ). By implication, the hypothesis was rejected since independent variables significant correlate with dependent variable at 0.05 level of significance in each case.

**H<sub>02</sub>:** JSC Mathematics and JSC Integrated science examination grades will not significantly predict the academic performance of students at the SSS2 unified Chemistry examinations.

**Table 2: Summary of regression analysis of the academic performance of students in JSC Mathematics and JSC Integrated science examination results with the SSS 2 unified Chemistry examinations results**

|  | Sum of squares | df   | Mean square | F      | Sig.  |
|--|----------------|------|-------------|--------|-------|
| R = 0.567<br>R <sup>2</sup> = 0.322<br>Adjusted R <sup>2</sup> = 0.320 |                |      |             |        |       |
| Regression   | 266.343        | 2    | 133.171     | 91.639 | 0.000 |
| Residual   | 2649.215       | 1823 |             |        |       |
| Total  | 2915.558       | 1825 |             |        |       |

P < 0.05, significant results  
 Dependent variable: UNICHM  
 Predictors (constant), JSCMTH, JSCs

The results in table 2 showed the academic performance of students in JSC Mathematics and JSC Integrated science on SSS2 unified Chemistry examination results ( $F = 91.639$ ,  $P < 0.05$ ). Thus, the hypothesis 2 was rejected. The result revealed that there was positive correlation between the academic performance of students in JSC Mathematics, JSC Integrated science and SSS2 unified Chemistry examination results. ( $R = 0.567$ ,  $P < 0.05$ ). The value of the coefficient of determination ( $R^2 = 0.322$ ) indicated that the predictor variables jointly accounted for 32.2% of the variance in criterion

**H03:** JSC Mathematics and JSC Integrated science examination grades will not significantly predict the academic performance of students at the WAECSSC Chemistry examinations.

**Table 3: Summary of Regression analysis of the academic performance of students in JSC Mathematics and JSC Integrated science examination results with the WAECSSC Chemistry examination results**

|  | Sum of squares | df   | Mean square | F       | Sig.  |
|--|----------------|------|-------------|---------|-------|
| R = 0.602<br>R <sup>2</sup> = 0.362<br>Adjusted R <sup>2</sup> = 0.361 |                |      |             |         |       |
| Regression   | 916.423        | 2    | 458.211     | 220.297 | 0.000 |
| Residual   | 3789.712       | 1825 | 1825        |         |       |
| Total  | 4706.13        |      | 1825        |         |       |

$P < 0.05$ , significant results

Dependent variable: WAEC CHM

Predictors (constant), JSCMTH, JSCS

The result in table 3 showed the academic performance of students in JSC Mathematics and JSC Integrated science on WAECSSC Chemistry examination results ( $F = 220.297$ ,  $P < 0.05$ ). Thus, the hypothesis 3 was rejected. The result showed that there was positive correlation between the academic performance of students in JSC Mathematics, JSC Integrated science and WAECSSC Chemistry examinations results ( $R = 0.602$ ,  $P < 0.05$ ). The value of the coefficient of determination ( $R^2 = 0.362$ ), indicated that the predictor variables jointly accounted for 36.2% of the variance in WAECSSC Chemistry examinations.

**H04:** JSC Mathematics and JSC Integrated science examination grades will not significantly predict the academic performance of students at the NECO SSC Chemistry examinations.

**Table 4: Summary of Regression analysis of the academic performance of Students in JSC Mathematics and JSC Integrated science examination results with the NECO SSC Chemistry examination results.**

|  | Sum of Squares | df   | Mean square | F      | Sig.  |
|--|----------------|------|-------------|--------|-------|
| R = 0.587<br>R <sup>2</sup> = 0.345<br>Adjusted R <sup>2</sup> = 0.343 |                |      |             |        |       |
| Regression   | 176.817        | 2    | 88.408      | 66.478 | 0.000 |
| Residual   | 2424.377       | 1823 | 1.330       |        |       |
| Total  | 2601.194       | 1825 |             |        |       |

P < 0.05, significant results  
Dependent variable: NECO CHM  
Predictors (constant), JSC MTH, JSCS

The results in table 4 showed the academic performance of students in JSC Mathematics and JSC Integrated science on NECO SSC Chemistry examination results ( $F = 66.478$ ,  $P < 0.05$ ). Therefore, the hypothesis 4 was rejected. The result showed that there was positive correlation between the academic performance of students in JSC Mathematics JSC Integrated Science and NECO SSC Chemistry examination results ( $R = 0.587$ ,  $P < 0.05$ ). The value of the coefficient of determination ( $R^2 = 0.345$ ) indicated that the predictor variables jointly accounted for 34.5% of the variance in NECOSSC Chemistry examinations.

### Discussion of Findings

Finding from hypothesis 1 revealed that there was significance relationship among the academic performance of students in JSC Mathematics, JSC Integrated science, SSS2 unified Chemistry, WAECSSC Chemistry and NECOSSC Chemistry examination results. The finding was not corroborated with the finding of Donald (2017) who found no significant relationship between the JSC Mathematics, JSC Integrated science and SSC Chemistry examination results. Finding from hypothesis 2 revealed that the academic performances of students in the JSC Mathematics examinations and JSC Integrated Science examinations were significant predictors of the academic performance of students in the SSS2 unified Chemistry examinations. This was in contrary to the findings made by Gideon (2016), who reported that the JSC Mathematics and Integrated Science examinations could not predict the academic performance of students at the SSC Chemistry examinations.

Finding from hypotheses 3 and 4 revealed that academic performances of students in the JSC Mathematics examinations and JSC Integrated Science examinations were significant predictors of the academic performance of students at the WAEC and NECO SSC Chemistry examinations. This was in consonance with the finding of Ojuola (2018), who reported that the JSC Mathematics examinations and JSC Integrated Science examinations were significant predictors of the academic performance of students at the SSC Chemistry 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 Chemistry examinations and found no significant relationship between the performance of students in the JSC Integrated Science and the SSC Chemistry 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 Integrated Science should have the ability to cope and perform brilliantly in the SSS2 unified examinations and SSCE in Chemistry. All things been equal, a student with good grades in Mathematics and Integrated Science JSCE should also obtain the same grades in SSS2 unified examinations and SSCE in Chemistry.

## Conclusion

Based on the findings of the study, it was concluded that JSC Mathematics and Integrated science examination grades would significantly predict the academic performance of students at the SSS2 unified, WAECSSC and NECOSSC Chemistry 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 Chemistry students into senior secondary schools as a way of achieving and maintaining good quality Chemistry education.
2. Parents and teachers should also provide the much-needed conducive atmosphere to learn Mathematics, Integrated science and Chemistry among other subjects.
3. 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 Chemistry examinations and SSC Chemistry examinations conducted by WAEC and NECO.

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