



# **S**TUDENTS' ACHIEVEMENT IN BASIC SCIENCE AS A PREDICTOR OF SCIENCE SUBJECTS IN SENIOR SECONDARY SCHOOLS IN SOUTH EAST GEO-POLITICAL ZONE, NIGERIA

## **ABSTRACT**

The study investigated students' achievement in basic science as a predictor of science Subjects in Senior Secondary Schools in South East Geo-Political Zone, Nigeria. Three research questions and its corresponding null hypotheses. The study adopted a descriptive survey of the ex-post facto research design type in which there was no treatment and manipulation of independent variable. The target population of the study consist of 26,9879 students' that registered for 2020/2021 SSCE in

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## **INTRODUCTION**

In any academic environment, predicting student achievement, obtaining valid, accurate and useful information about students is vital not only to the students but also to their parents, sponsors, teachers, counselors and government. To this end, the role of examinations in the assessment of students in educational institutions cannot be over emphasized. It stands as a fundamental tool of providing crucial academic information on students to all stake holders. The primary purpose of a curriculum based examination is evaluation to find out how much the learner has learned based on what he or she has been taught (Anikweze, 2015). Science and technology have developed at an ever increasing pace in western and other advanced countries. At the secondary education level Bajah (2013), basic science teaching in Nigeria is in two parts; junior secondary school, and senior secondary school. At the junior secondary level, the basic science curriculum is designed to introduce all students to the world of science, while at the senior secondary level; students are introduced to different discipline of the natural and physical sciences. It is expected that the Basic science curriculum will provide the relevant foundation on which senior secondary school students will build carriers in science or science related disciplines.



South East Geo-Political Zone, Nigeria were 1,518 students from ten (10) secondary schools were used as a sampled size of the study. A proforma (SPISSR) was used as an instrument for data collection, was validated which yielded 0.87 validity index and the 0.84 reliability index. The researcher made use of correlation and its associated simple regression of Ordinary Least Square (OLS) method to answered research questions and to test the null hypotheses at the 0.05 level of significance. Findings reveal that students' JSCE Basic science do not significantly predict their SSCE Biology scores, students' JSCE Basic science scores do not significantly predict their scores in SSCE Chemistry and Physics. Based on the findings of this study, the following were recommended: It was recommended that JSCE Basic Science curriculum be reviewed to be in conformity with the SSCE syllabus for science subjects in order to enhance its predictive validity, teaching and learning of basic science in junior secondary school should be enhanced so as to adequately equip students as it relates to their future studies in science.

**Keyword:** Students' achievement, basic science, predictive validity, of science subjects, SSCE

Ogunniyi (2012), described science as an attempt by man to organize his experiences about nature into meaningful and logical system of explanation of basic science.

Basic science is really the integration of 'all' science subjects (which appear more like a scrappy fusion of biology, chemistry and physics). As Bajah (2013) reported in his study of the concept of science in secondary schools contended, that integration when applied to science courses means that the course is devised and presented in such a way that students gain the concept of fundamental unity of science. Basic science is taken as a subject to be taught by the conventional science teacher and regarded as a subject in the department of science where the natural subjects – chemistry, physics and biology is taken as the senior secondary school subject. Bajah (2013), wrote that the word 'integrated' implies teaching science in such a way as to present scientific ideas as a unified whole; emphatically stating that Basic science is science come a life. Osokoya (2018) asserted that sciences embrace many disciplines from which basic science as a school subject emanated and valid.

Validity of a test refers to the extent to which a test, instrument or construct measures what it is supposed to measure Anikweze (2015). A valid test must measure accurately and consistently what it is designed to measure and nothing else. A valid test must satisfy both the edumetric and psychometric functions of evaluation. According to Bebefiafia (2013), predictive validity is a measurement of how well a test predicts future performance. It is a form of criterion validity, in which the validity of a test is established by measuring it against known criteria. In order for a test to have predictive validity, there must be a statistically significant correlation between test scores and the criterion being used to measure validity.



An assessment of students' achievement in Basic science (biology, chemistry and physics) shows that the average performances of students at JSCCE basic science in Government secondary schools in South –East 2020/2021 stands at 76.13percent pass. On the other hand, the average achievement of student in SSCE biology, chemistry and physics for the same period is 73.47 percent, 50.70 percent and 37.40 percent respectively. It can be observed from these results that the achievement in JSCCE Basic science and SSCE biology chemistry and physics varies remarkably. Students' achievement in the sciences at SSCE over the years is not on the high side. For example, students who sat for may June 2020 SSCE in biology, chemistry and physics had the following percentages pass 59.78 percent, 48.65 percent and 43.36 percent respectively for the whole country (WAEC annual report 2021). Since these results are not too impressive, there is thus the need to determine the relationship between JSSCE Basic science and SSCE biology, chemistry and physics in the view of the good achievement of student at JSCCE Basic science.

Achievement is the end product of a learning experience (Osokoya 2008). Taking the various learning experience of a child in the JSCCE Basic science course as a whole, student's achievement in the JSCCE is their achievement in science in JSS. In most schools the basic prerequisite for placement of students in the senior class is the JSCCE results. The implicit assumption is that the grade obtained by a student in Basic science JSCCE should predict their achievement in the various science subjects offered at the senior secondary school (SSS) and hence their success at SSCE biology, chemistry and physics. Over the years, students' achievement in basic science in Nigerian schools is a thing of concern for the low standard of science education. Educational stake have been worried about the Basic science results obtained by students at the senior secondary school certificate examinations.

Similarly, there are instances of candidates performing well in Basic science at JSCCE and failing in science examinations at SSCE or the reverse in which candidates perform poorly in Basic science and pass well in science examinations. Some researchers opined that something must be wrong with either of the subjects. There is no doubt that many factors may be accountable for the observed anomaly. On the other hand, the average achievement of student in SSCE biology, chemistry and physics 2021/2022 academic year is 73.47 percent, 50.70 percent and 37.40 percent respectively. It can be observed from these results that the achievement in JSCCE Basic science and SSCE biology chemistry and physics varies remarkably students' achievement in the sciences at SSCE over the years is not encouraging. Since these results are not the same, there is thus the need to determine the relationship between JSSCE Basic science and SSCE biology, chemistry and physics in the view of the good achievement of student at JSCCE basic science, hence, students' achievement in basic science as a predictor of science subjects in senior secondary schools in South East Geo-Political Zone, Nigeria.

Several literatures related to this study were discussed such as Galle and Kukwi (2020) assessed the continuous assessment and common-mock scores as a predictor of academic performance of Economics students in WASSCE examinations in Nasarawa state, Nigeria. Findings shows that continuous assessment and common-mock scores are good predictor of



Economics students' academic performances in WASSCE to a tolerant to some extent. Further result indicated that there is a significant relationship between common mock scores and academics performance of male and female students in Economics WASSCE may/June 2011-2019 years in Nasarawa State secondary schools among others. Babalola and Habila (2020) findings showed that there was a weak positive relationship between CA scores and JSCE in Mathematics in 2014/2015 and 2016/2017, there was very weak negative relationship between CA scores and JSCE in 2015/2016 academic session. The JSCE performance of students in Mathematics could be predicted from CA scores for 2014/2015 and 2016/2017 academic sessions while it could not be predicted for 2015/2016 academic session. Allwell and Longjohn (2019) findings of the study showed that JSCE Basic Science is not a potent predictor of SSCE Biology performance ( $\beta = 0.030, P > .05$ ). Also, gender of students who took the JSCE Basic Science had no significant prediction on SSCE Biology performance (Female  $\beta = -0.016, P > .05$ ; Male  $\beta = 0.066, P > .05$ ). Dike, Ngozi, and Garba (2019) findings of the study revealed that achievement of students in Integrated Science significantly predict their later achievement in Biology at SSCE irrespective of their gender.

### **Research Questions**

The following research questions were raised to guide the study:

1. To what extent does students' achievement scores in JSCE Basic science predict their achievement scores in SSCE Biology
2. To what extent does students' achievement scores in JSCE Basic science predict their achievement scores in SSCE Chemistry?
3. To what extent does students' achievement scores in JSCE Basic science predict their achievement scores in SSCE Physics

### **Hypotheses**

The following hypotheses raised to guide the study

- Ho1:** Students' achievement scores in JSCE basic science do not significantly predict their achievement scores in SSCE Biology
- Ho2:** students' achievement scores in JSCE Basic science not significantly predict their achievement scores in SSCE Chemistry
- Ho3:** students' achievement scores in JSCE basic science not significantly predict their achievement scores in SSCE Physics

### **Material and Methods**

#### **Design**

The study adopted a descriptive survey of the ex-post facto research design type in which there was no treatment and manipulation of independent variable. It involves the collection of data from examination records of Junior school certificate examination (JSCE) and senior school certificate examination (SSCE).



### **Population and Sampling Techniques**

The target population of the study consist of 36,9879 students' schools that registered for 2020 2021 final year examination in science subjects Biology, Chemistry and Physics in South East Geo-Political Zone, Nigeria secondary schools namely: Abia, Anambra, Enugu, Ebonyi and Imo.

Multi-stage stratify random sampling techniques was adopted to select sample of 1,518 students from ten (10) secondary schools in Ebonyi and Enugu States, three (3) LGAs to include special science school Abakaliki, government secondary school Afikpo South and comprehensive secondary school Ezza North while four (4) LGA, government secondary school Abakpa Nike Enugu East, Enugu South, government secondary school Enugu-North and government secondary school Nkanu West-Enugu State, government secondary school Owerri, Imo State, government secondary school Abia north, and Government Secondary Schools In Anambra East, Anambra State making the total of ten (10) LGAs. The researchers made online contact and face to face contact was made using exams officers of the various schools and collected the data.

### **Instrument for Data Collection**

Instrument for data collection was a proforma designed by the researchers in the following: The copies of JSCE score sheets for period of 2020-2021 years' basic science and science subjects. The Proforma (instrument) is called 'Students' Proforma for Basic science and Science Results' (SPISSR). The proforma consists of seven columns for (1) serial number, (2) registration number, (3) sex, (subjects); (4) Basic science, (5) Biology, (6) Chemistry and (7) Physics scores JSCE/SSCE computerized result sheets from each sampled schools respectively.

### **Validation and Reliability of Instrument**

Students' Proforma for Basic science and Science Results (SPISSR) was subjected to experts' judgment for validation. Two experts in Educational Measurement and Evaluation validated the instrument by checking for appropriateness, and relevance of the items which yielded 0.87 validity index and the 0.84 reliability index was obtained. The reliability result of SPISSR was compared with the guidelines for interpreting alpha coefficients suggested by Ugodulunwa and Okolo as cited in Galle, Ezeofor and Ofomata (2022) that " $\alpha \geq 0.9$  excellent,  $\geq 0.8$  good,  $\geq 0.7$  acceptable,  $\geq 0.6$  questionable,  $\geq 0.5$  poor,  $\leq 0.5$  unacceptable". Therefore, the results of the reliability enabled the researchers to use the SPISSR since the correlation was considered high and significant.

### **Administration of Instrument**

The instrument was administered by the researcher with prior arrangement with the schools concerned via a researchers' introductory letter. With the aid of the school Principals, the consent of the school Examination Officers was sought, he gave me unhindered access to the exams record where the researchers collected the data. The privacy of information and other



ethical sureties were guaranteed by the researcher.

### Technique for Data Analysis

Descriptive statistics of mean and standard deviation were used to answer the research questions to indicate the existence and strength of any relationship between two or more variables. The researcher made use of correlation and its associated simple regression of Ordinary Least Square (OLS) method to establish relationship between the variables and to test the null hypotheses at the 0.05 level of significance. Finally, coefficient of determination was computed to measure the extent to which Basic science scores predicts students' achievement in science subjects on a composite level and on individual subject level. The results were presented in tables below.

### Results

#### Research Questions/ Hypotheses

**Research Question 1:** To what extent does students' achievement scores in JSCE Basic science predict their achievement scores in SSCE Biology?

**Table 1: Coefficients of Correlation between JSCE Basic science scores and SSCE Physics Score 2020/2021**

Model	N	R	R-Square	Remark
JSCE/SSCE	1,518	0.631	0.351	Weak

In Table1, shows correlation coefficients ( $r$ ) for students' JSCE basic science scores and their SSCE Physics scores was 0.63 indicate that there exists positive relationship between students' JSCE basic science scores and their SSCE. Biology scores. From the analysis, the coefficient of determination ( $r^2$ ) 0.351 indicates that 35.1 percent of the total variations in the criterion variable (SSCE Biology scores) was explained by the variation in the predictor variable (JSCE Basic science scores). This indicates a weak predictive validity for JSCE Basic science scores. To test the variation,  $H_0$  was tested at 95% confident level and the result is shown in table 2.

Biology at SSCE.

**$H_0$ :** Students' achievement scores in JSCE basic science do not significantly predict their achievement scores in SSCE Biology

**Table 2: Summary Regression Analysis for JSCE Basic Science Scores and Biology SSCE**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	41.518	3.753		.817	0.11	43.339	78.098
JSCE SSCE	0.5	0.56	0.46	2.10	0.410	0.154	0.64



Table 2 shows correlation coefficients (r) for students' JSCE basic science scores and their SSCE Physics scores is  $Y = 41.518 + 0.46X$ . It implies that for a unit increase in X (JSCE Basic Science Grades), Y (SSCE Biology scores) will increase by 0.46. Furthermore, at the 0.05 level of significance and degree of freedom of 1,517, the t-test value is 2.10 which is greater than the P-value of 1.98. Therefore, since the calculated value of t-test is greater than its P-value, the  $H_0$  is therefore accepted. The finding is that students' JSCE Basic science grades do not significantly predict their SSCE Biology scores.

**Research Question 2:** To what extent does students' achievement scores in JSCE Basic science predict their achievement scores in SSCE Chemistry?

**Table 3: Coefficients of Correlation between JSCE Basic science scores and SSCE Chemistry Score 2020/2021**

Model	N	R	R Square	Remark
JSCE/SSCE	1,518	0.64	0.371	Weak

In Table3, shows correlation coefficients (r) for students' JSCE basic science scores and their SSCE Chemistry scores was 0.64 indicate that there exists positive relationship between students' JSCE basic science scores and their SSCE Chemistry scores. From the analysis, the coefficient of determination ( $r^2$ ) 0.371 indicates that 37.1 percent of the total variations in the criterion variable (SSCE Chemistry scores) was explained by the variation in the predictor variable (JSCE Basic science scores). This indicates a weak predictive validity for JSCE Basic science scores. To test the variation  $H_0$  was tested at 95% confident level and the result is shown in table 4.

**$H_0$ :** students' achievement scores in JSCE Basic science not significantly predict their achievement scores in SSCE Chemistry

**Table 4: Summary Regression Analysis for JSCE Basic Science Scores and SSCE Chemistry Scores**

Model	Unstandardize d Coefficients		Standardize d Coefficients	T	Sig.	95.0% Confidence Interval	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	60.718	3.753		0.817	0.11	63.339	78.098
JSCE SSCE	0.5	0.56	0.43	2.10	0.420	0.154	0.64



Table 4 shows regression equations for predicting students grades in Chemistry at SSCE from JSCE Basic Science Scores is  $Y = 61.718 + 0.43X$ . It therefore, means that for a unit increase in X (JSCE Basic Science Scores), Y (SSCE Chemistry Scores) will increase by 0.43. Furthermore, at the 0.05 level of significance and degree of freedom of 1,517, the t-test value is 2.10 which is greater than the P-value of 1.98. Therefore, since the calculated value of t-test is greater than its P-value, the null hypothesis is therefore accepted. The finding is that students' JSCE Basic science grades do not significantly predict their scores in SSCE Chemistry.

**Research Question 3:** To what extent does students' achievement scores in JSCE Basic science predict their achievement scores in SSCE Physics

**Table 5: Coefficients of Correlation between JSCE Basic science scores and SSCE Physics Score 2020/2021**

Model	N	R	R Square	Remark
JSCE/SSCE	1,518	0.66	0.372	Weak

In Tables, shows correlation coefficients (r) for students' JSCE basic science scores and their SSCE Physics scores was 0.66 indicate that there exists positive relationship between students' JSCE basic science scores and their SSCE Physics scores. From the analysis, the coefficient of determination ( $r^2$ ) 0.372 indicates that 37.2 percent of the total variations in the criterion variable (SSCE Physics scores) was explained by the variation in the predictor variable (JSCE Basic science scores). This indicates a weak predictive validity for JSCE Basic science scores.

significance level. To test the variation  $H_03$  was tested at 95% confident level and the result is shown in table 6.

**$H_03$ :** students' achievement scores in JSCE basic science not significantly predict their achievement scores in SSCE Physics

**Table 6: Summary Regression Analysis for JSCE Basic Science Grades and Grades in Physics at SSCE**

Model		Unstandardize		Standardize	t	Sig.	95.0% Confidence Interval	
		d Coefficients	Std. Error	d Coefficients			Lower Boun d	Upper Boun d
1	(Constant)	54.644	4.136		0.812	0.10	55.501	71.777
	JSCE SSCE	0.5	0.61	0.66	1.55	0.417	0.61	0.170



Table 6 shows regression equations for students' achievement scores in JSCE basic science predicting their SSCE Physics scores is  $Y = 54.644 + 0.61X$ . It implies that for a unit increase in X (JSCE Basic Science scores), Y (SSCE Physics scores) will increase by 0.61. Furthermore, at the 0.05 level of significance and degree of freedom of 1,517, the t-test value is 1.55 which is less than the critical value of 1.96. Therefore, since the calculated value of t is less than its P-value, the null hypothesis three is therefore rejected. The finding is that students' JSCE Basic science scores significantly predict their SSCE Physics scores.

### **Discussion of findings**

In Table1, shows correlation coefficients (r) for students' JSCE basic science scores and their SSCE Physics scores was 0.63 indicate that there exists positive relationship between students' JSCE basic science scores and their SSCE. Biology scores. From the analysis, the coefficient of determination ( $r^2$ ) 0.351 indicates that 35.1 percent of the total variations in the criterion variable (SSCE Biology scores) was explained by the variation in the predictor variable (JSCE Basic science scores). This indicates a weak predictive validity for JSCE Basic science scores. To test the variation,  $H_{01}$  was tested at 95% confident level. Drawing inferences from  $H_{01}$  in Table 2 shows correlation coefficients (r) for students' JSCE basic science scores and their SSCE Physics scores is  $Y = 41.518 + 0.46X$ . It implies that for a unit increase in X (JSCE Basic Science Grades), Y (SSCE Biology scores) will increase by 0.46. Furthermore, at the 0.05 level of significance and degree of freedom of 1,517, the t-test value is 2.10 which is greater than the P-value of 1.98. Therefore, since the calculated value of t-test is greater than its P-value, the  $H_{01}$  is therefore accepted. The finding is that students' JSCE Basic science grades do not significantly predict their SSCE Biology scores. Allwell and Longjohn (2019) findings of the study showed that JSCE Basic Science is not a potent predictor of SSCE Biology performance ( $\beta = 0.030$ ,  $P > .05$ ). Also, gender of students who took the JSCE Basic Science had no significant prediction on SSCE Biology performance (Female  $\beta = -0.016$ ,  $P > .05$ ; Male  $\beta = 0.066$ ,  $P > .05$ ). Dike, Ngozi, and Garba (2019) findings of the study revealed that achievement of students in Integrated Science significantly predict their later achievement in Biology at SSCE irrespective of their gender.

Similarly, In Table3, shows correlation coefficients (r) for students' JSCE basic science scores and their SSCE Chemistry scores was 0.64 indicate that there exists positive relationship between students' JSCE basic science scores and their SSCE Chemistry scores. From the analysis, the coefficient of determination ( $r^2$ ) 0.371 indicates that 37.1 percent of the total variations in the criterion variable (SSCE Chemistry scores) was explained by the variation in the predictor variable (JSCE Basic science scores). This indicates a weak predictive validity for JSCE Basic science scores. To test the variation  $H_{02}$  was tested at 95% confident level. Drawing inferences from  $H_{02}$  in Table 4 shows regression equations for predicting students grades in Chemistry at SSCE from JSCE Basic Science Scores is  $Y = 61.718 + 0.43X$ . It therefore, means that for a unit increase in X (JSCE Basic Science Scores), Y (SSCE Chemistry Scores) will increase by 0.43. Furthermore, at the 0.05 level of significance and degree of freedom of 1,517, the t-



test value is 2.10 which is greater than the P-value of 1.98. Therefore, since the calculated value of t-test is greater than its P-value, the null hypothesis is therefore accepted. The finding is that students' JSCE Basic science grades do not significantly predict their scores in SSCE Chemistry. This findings corroborated the finding of Babalola and Habila (2020) findings showed that there was a weak positive relationship between CA scores and JSCE in Mathematics in 2014/2015 and 2016/2017, there was very weak negative relationship between CA scores and JSCE in 2015/2016 academic session. The JSCE performance of students in Mathematics could be predicted from CA scores for 2014/2015 and 2016/2017 academic sessions while it could not be predicted for 2015/2016 academic session.

Finally, Table5, shows correlation coefficients ( $r$ ) for students' JSCE basic science scores and their SSCE Physics scores was 0.66 indicate that there exists positive relationship between students' JSCE basic science scores and their SSCE Physics scores. From the analysis, the coefficient of determination ( $r^2$ ) 0.372 indicates that 37.2 percent of the total variations in the criterion variable (SSCE Physics scores) was explained by the variation in the predictor variable (JSCE Basic science scores). This indicates a weak predictive validity for JSCE Basic science scores.

significance level. To test the variation  $H_{03}$  was tested at 95% confident level. Drawing inference from  $H_{03}$  in Table 6 shows regression equations for students' achievement scores in JSCE basic science predicting their SSCE Physics scores is  $Y = 54.644 + 0.61X$ . It implies that for a unit increase in  $X$  (JSCE Basic Science scores),  $Y$  (SSCE Physics scores) will increase by 0.61. Furthermore, at the 0.05 level of significance and degree of freedom of 1,517, the t-test value is 1.55 which is less than the critical value of 1.96. Therefore, since the calculated value of  $t$  is less than its P-value, the null hypothesis three is therefore rejected. The finding is that students' JSCE Basic science scores significantly predict their SSCE Physics scores. This finding is in agreement with that of Galle and Kukwi (2020) findings shows that continuous assessment and common-mock scores are good predictor of Economics students' academic performances in WASSCE to a tolerant to some extent. Further result indicated that there is a significant relationship between common mock scores and academics performance of male and female students in Economics WASSCE may/June 2011-2019 years in Nasarawa State secondary schools among others.

### **Conclusion**

In view of the findings of this study, the following conclusions were drawn: there is significant relationship between the students' achievement scores in Basic science JSCE and their mean scores in science subjects SSCE. Students' achievement in basic science predicts their performance in Biology. It should be emphasized that Basic science is really the integration of 'all' science subjects like Biology, Chemistry and physics. The concept of science in secondary schools contended that integration when applied to science courses means that the course is devised and presented in such a way that students gain the concept of fundamental unity of



science. This can be seen in the application of scientific principle to life, appreciation of nature and understanding natural phenomena

### **Recommendations**

Based on the findings of this study, the following were recommended:

1. It was recommended that JSCE Basic Science curriculum be reviewed to be in conformity with the SSCE syllabus for science subjects (Biology) in order to enhance its predictive validity.
2. The teaching and learning of basic science in Junior Secondary School should be enhanced so as to adequately equip students as it relates to their future studies in science.
3. Classroom teachers should try as much as possible to relate the concept of basic science to physics, chemistry and biology.
4. Students should be motivated to learn basic science with seriousness it deserved, since it predicts their performance in science subjects

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