Basic Science Junior School Certificate Examination As Predictor Of Senior School Certificate Examination In Physics, Chemistry And Biology In Aba Metropolis Of Abia State Nigeria

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Abstract: *The study investigated Basic Science Junior School Certificate Examination as predictor of Senior School Certificate Examination in Physics, Chemistry and Biology in Aba Metropolis of Abia State, Nigeria. Three research questions and three null hypotheses guided the study. The design of the study is correlational. A sample size of 472 students was drawn out of 3098 students from 10 schools out of 15 schools who sat for JSCE Basic Science and SSCE science subjects in 2011 and 2014 respectively through simple, stratified and purposive sampling techniques. The 2011 JSCE Basic Science results and SSCE results in Physics, Chemistry and Biology were used for data collection. Simple regression analysis was used to answer the research questions while analysis of variance (ANOVA) and t-test associated with the regression were used to test the null hypotheses at 0.05 alpha level. The results revealed that JSCE Basic Science significantly predicted Physics, Chemistry and Biology in Senior School Certificate Examination. There was a low prediction between Basic Science and Physic, moderate between Basic Science and Chemistry and high between Basic Science and Biology. On the basis of these findings, it was recommended among others that Basic Science curriculum should have a good coverage of all science subjects.*
Keywords: *JSCE, SSCE, Basic Science, Physics, Chemistry and Biology.*

I. Introduction

Science education is the foundation for scientific and technological development. It is the area of study that raises a society with scientific knowledge. Science education is the bedrock for advanced studies in science which provides the basic scientific knowledge, skills and experience for the students. Wikipedia, a free encyclopedia (ND) stated that science education is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community. The learners may be children, college students or adults within the general public. Science education is a process of teaching and learning which provides the fundamental principles, skills and attitudes for future work in science.

Science education is a very important tool for individual and national development. It is widely and generally acknowledged that the gateway to the survival of any nation scientifically and technologically is science literacy. There is no doubt that the main distraction between the developed and developing countries is the degree of scientific development in these countries. According to Akpan (2008), the phenomenal rate of economic growth of Japan, Taiwan South Korea, Malaysia, Thailand, China and Singapore is based on their ability to harness the fruits of science and technology. For Nigeria to harness the fruits of science and technology and ultimately change from a nation that is predominantly a producer of raw materials and a consumer of finished products, to a nation with industrial economy, science education must be given urgent and adequate attention.

Umoru and Bake (2007) stated that for Nigeria to survive and be self reliant in the growing world economy a greater percentage, if not all the citizens should be aware and accept the idea of laying a sound foundation for science and technology in the school system. Science education is supposed to be fully developed in all facets and among citizens, in order to have the required achievements. The introduction of science subjects into the curriculum of Nigerian secondary schools proves the fact that the country appreciates the role of science as a factor of national development.

Basic science (formerly known as integrated science) is a subject of study that covers all aspects of science as a unit. It is a curriculum which is concerned with the teaching and learning of the fundamental units of science methods, processes, thoughts strategies and theories as a unitary body. Basic science is a multi-disciplinary course which provides a meaningful understanding of science without differentiating it into various

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scientific fields. Basic science lays the foundation for advance studies in science and technology. It is the science subject offered in the primary and junior secondary schools and also offered as a course of study in the school of education in Nigeria tertiary institutions. Its' curriculum is a compilation of subject matter drawn from physics, chemistry and biology which are three divisions of science subjects in the senior secondary school.

The Senior Secondary Certificate Examination (SSCE) is written at the end of three –year senior secondary programme. The Senior School Certificate Examination (SSCE) serves as an end of course evaluation for all secondary school graduates. Offor (2011) asserted that all purpose of this examination is to ascertain to what degree students in a particular course have achieved the course or educational objectives. The West African Examination Council (WAEC) and the National Examination Council are responsible for the conduction of the Senior Secondary Certificate Examination (SSCE) for eligible candidates at the completion of three year senior secondary programme. According to WAEC (2002), the pattern of grading candidates, scores in the examination was such that the distinction grades were represented by A_1 B_2 and B_3; the credit grades were represented by C_4 to C_6. The ordinary pass grade was represented by D_7 and D_8 while failure grade was represented by F_9.

Junior Secondary Certificate Examination (JSCE) is the examination written at the end of the 9-year Universal Basic Education (UBE) programme and serves as the entry requirement into senior secondary school. The State Ministry of Education is responsible for the conduction of the JSCE for the various schools in the state. A minimum of credits/passes in five subjects including English and Mathematics qualifies a student who sat for JSCE for admission into the senior secondary school programme (Elishama, 2014). The junior secondary education provides both vocational and academic programmes for the students to enable them acquire knowledge and skills that will help them to make appropriate choice of career in the future. At the end of the junior secondary education, the JSCE is conducted as a summative evaluation for the students to determine their level of academic and vocational achievement. After the JSCE, students have the option of going into trade, vocational training or to continue with their academic programme.

Students' performance in the various subjects in the JSCE determines their area of study in the senior secondary school programme. For instance, for a student to study the science subjects in the senior secondary school, the student must obtain a credit pass in basic science in JSCE. A student who did very well in basic science at JSCE is expected to cope adequately with the academic challenges of the science subjects in the senior secondary school. However, this has not always been the case considering the mass failure that had been recorded in the science subjects in SSCE. It is evident that these students who obtained these mass failures in SSCE are the same students who obtained acceptable grades in their JSCE and were consequently admitted to senior secondary school (Falaye & Afolabi, 2005). Many predictive validity studies have been done by educational researchers to identify variables that can be used to forecast academic and vocational success. Ikiroma (2008), Falaye and Afolabi (2005), Adebola (2004) and Opara and Nwaukwu (2016) investigated on predictive validity of junior secondary certificate examination on senior secondary certificate examination and found positive and low relationship between JSCE and SSCE. To the best of the researchers' knowledge, not much have been carried out on predictive validity of JSCE in Basic Science on achievement in SSCE in Physics, Chemistry and Biology and also not in the same area of the study. This is the gap which the present study filled.

The aim of this study was to investigate the extent Basic Science Junior School Certificate Examination (JSCE) predict Senior School Certificate Examination in Physics, Chemistry and biology in Aba metropolis of Abia State Nigeria.

The following research questions guided the study:
1. To what extent do students' scores in JSCE Basic Science predict their performance in SSCE physics in Aba metropolis of Abia State?
2. To what extent do students' scores in JSCE Basic Science predict their performance in SSCE Chemistry in Aba metropolis of Abia State?
3. To what extent do students' scores in JSCE basic science predict their performance in SSCE biology in Aba metropolis of Abia State?

The following null hypotheses which were formulated and tested at 0.05 alpha levels guided the study:
1. Students' JSCE Basic Science scores do not significantly predict their SSCE performance in Physics in Aba metropolis of Abia State.
2. Students' JSCE Basic Science scores do not significantly predict their SSCE performance in chemistry in Aba metropolis of Abia State.
3. Students' JSCE Basic Science scores do not significantly predict their SSCE performance in biology in Aba metropolis of Abia State.

II.   Methods

The study was conducted using correlational research design. Correlational design was defined by Kpolovie (2010) as a design which investigates the magnitude and direction or nature (positive or negative) of relationship that exists between a dependent variable and one or more independent variables. The population of this study comprised of all the students who sat for JSCE Basic Science in 2011 also sat for the science subjects (Physics, Chemistry, Biology) at SSCE in 2014 in all the government secondary schools in Aba metropolis. At the time of this study, there were 3098 students who sat for JSCE Basic Science and SSCE science subjects in the fifteen (15) government secondary schools in Aba metropolis (sources: WAEC Umuahia and Research and Statistics Unit of Secondary Education Management Board, Aba Zonal Office 2016). The representative sample for this study was 472 students drawn from ten (10) schools out of fifteen (15) government secondary schools in Aba metropolis through simple, stratified and purposive sampling techniques respectively. The data used for this study were the 2011 JSCE Basic Science results and 2014 SSCE results in Physics, Chemistry and Biology which were collected from the WAEC office Umuahia and Research and Statistics Unit SEMB Aba Zonal Office. The researchers adopted the simple regression analysis to answer the research questions while Analysis of Variance (ANOVA) and t-test values associated with the regression was used to test the null hypotheses at 0.05 alpha level.

III.   Results

Research Question 1: To what extent do students' scores in JSCE Basic Science predict their performance in SSCE Physics in Aba metropolis of Abia State?
Hypothesis 1:   Students' JSCE Basic Science scores do not significantly predict their SSCE performance in physics in Aba metropolis of Abia State.

In order to answer the research question, simple regression was employed while testing the null hypothesis Analysis of variance (ANOVA) and t-test associated with the regression were employed.

Table 1: Simple regression analysis of students' scores in JSCE Basic Science as predictor of their performance in SSCE Physics.

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
	.531	.282	.281	.642

Analysis of Variance (ANOVA

	Sum of Squares	df	Mean Square	F	Sig
Regression	76.173	1	76.173	184.82	.000
Residual	193.706	470	.412		
Total	269.879	471			

Model	Unstandardized coefficients		standardized coefficients	t	Sig
	B	Std Error	Beta		
Constant	1.421	.106		13.466	.000
Physics	.506	.037	.531	13.595	.000

Table 1 reveals that the simple regression yielded a coefficient of .531, R^2 of .282, adjusted R^2 of .281 and standard error of the estimate of .642. This indicates that students' performance in JSCE Basic Science accounts for 28.2% of the variance in the performance of students in SSCE physics while 71.8% of the variance in the students' performance in SSCE Physics cannot be explained by their performance in JSCE Basic Science. However, to determine if the prediction is significant or not, analysis of variance (ANOVA) associated with simple regression was employed. The calculated F-value of 184.823 was significant at .000 which is less than the chosen alpha level of 0.05 ($p < 0.05$). Hence, the null hypothesis is rejected indicating that students' performance in JSCE Basic Science significantly predicts their performance in SSCE physics. For further confirmation of the prediction of students' performance in SSCE physics by their performance in JSCE Basic Science, the t-value associated with regression was also used. The table also shows that the beta value of .531 which was significant based on its t-value of 13.595 was significant at 0.000 level which is less than the chosen probability level of 0.05 ($p < 0.05$). Therefore, the null hypothesis of no significant prediction of students' SSCE physics by their JSCE Basic Science is rejected. That means that students' performance in JSCE Basic Science significantly predicts their performance in SSCE physics in Aba metropolis of Abia State. The regression equation for students' performance in SSCE physics is Y = 1.421 + .506 x, where x is the raw score for each student in JSCE Basic Science.

Research Question 2: To what extent do students' scores in JSCE Basic Science predict their performance in SSCE chemistry in Aba metropolis of Abia State?

Hypothesis 2: Students' JSCE Basic Science scores do not significantly predict their SSCE performance in chemistry in Aba metropolis of Abia State.

In order to answer the research question, simple regression was used while testing the null hypothesis ANOVA and t-test associated with the regression were employed.

Table 2: Simple regression analysis of students' scores in JSCE Basic Science as predictor of their performance in SSCE Chemistry.

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
	.759	.576	.575	.494

Analysis of Variance (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig
Regression	155.397	1	155.397	637.968	.000
Residual	114.483	470	.244		
Total	269.879	471			

Model	Unstandardized coefficients		standardized coefficients	t	Sig
	B	Std Error	Beta		
Constant	.261	.103		2.535	.012
Chemistry	.848	.034	.759	25.258	.000

Table 2 shows that the simple regression yielded a coefficient of .759, R^2 of .576, adjusted R^2 of .575 and standard error of the estimate of .494. This reveals that students' performance in JSCE Basic Science accounts for 57.6% of the variance in the performance of students' in SSCE chemistry while 42.4% of the variance in the performance of students in SSCE chemistry cannot be explained by their performance in JSCE Basic Science. However, to determine if the prediction is significant or not, Analysis of Variance (ANOVA) associated with simple regression was employed. The calculated F – value of 637.968 was significant at .000 which is less than the chosen alpha level of 0.05 ($p < 0.05$). Hence, the null hypothesis is rejected indicating that students' performance in JSCE Basic Science significantly predicts their performance in SSCE Chemistry. For further confirmation of the prediction of students' performance in SSCE chemistry by their performance in JSCE Basic Science, the t-value associated with regression was also used.

The table also reveals that the beta value of .759 which was significant based on its t-value of 25.26 was significant at .000 level which is less than the chosen probability level of 0.05 ($p < 0.05$). Therefore, the null hypothesis of no significant prediction of students' SSCE Chemistry by their JSCE Basic Science is rejected. This implies that students' performance in JSCE Basic Science significantly predicts their performance in SSCE chemistry in Aba metropolis of Abia State. The regression equation for students' performance in SSCE chemistry is Y = .261 + .843 x, where x is the raw score for each student in JSCE Basic Science.

Research Question 3: To what extent do students' scores in JSCE Basic Science predict their performance in SSCE Biology in Aba metropolis of Abia State?

Hypothesis 3: Students' JSCE Basic Science scores do not significantly predict their SSCE performance in Biology in Aba metropolis of Abia State.

In order to answer the research question, simple regression was employed while testing the null hypothesis ANOVA and t-test associated with the regression was employed.

Table 3: Simple regression analysis of students' scores in JSCE Basic Science as predictor of their performance in SSCE Biology.

Model	R	R^2	Adjusted R^2	Std. Error of Estimate
	.848	.719	.718	.402

Analysis of Variance (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig
Regression	194.029	1	194.029	1202.280	.000
Residual	75.850	470	.161		
Total	269.879	471			

Model	Unstandardized coefficients		standardized coefficients	t	Sig
	B	Std Error	Beta		

Constant	.119	.079			
Biology	.890	.026	.848	34.674	.000

Table 3 reveals that the simple regression yielded a coefficient of .848, R^2 of .719, adjusted R^2 of .718 and standard error of the estimate of .402. This shows that students' performance in JSCE Basic Science accounts for 71.9% of the variance in the performance of students' in SSCE Biology while 28.1% of the variance in the performance of students' in SSCE Biology cannot be explained by their performance in JSCE Basic Science. However, to determine if the prediction is significant or not, Analysis of Variance (ANOVA) associated with simple regression was employed. The calculated F-value of 1202.280 was significant at .000 which is less than the chosen probability level of 0.05 ($p < 0.05$). Hence, the null hypothesis is rejected indicating that students' performance in JSCE Basic Science significantly predicts their performance in SSCE Biology. For further confirmation of the prediction of students' performance in SSCE Biology by their performance in JSCE Basic Science, the t-value associated with regression was also used. The table also reveals that the beta value of .848 which was significant based on its t-value of 34.674 was significant at .000 level which is less than the chosen probability level of 0.05 ($p < 0.05$). Therefore, the null hypothesis of no significant prediction of students' SSCE biology by their JSCE Basic Science is rejected. This means that students' performance in JSCE Basic Science significantly predicts their performance in SSCE Biology in Aba metropolis of Abia State. The regression equation for students' performance in SSCE biology is $Y = .119 + .890 x$, where x is the raw score for each student in JSCE Basic Science.

IV. Discussion Of Findings

The result with respect to research question one indicates that there is a positive low relationship between students' performance in JSCE Basic science and their performance in SSCE physics. The positive relationship means that as performance in JSCE Basic science increases, there is a corresponding increase in SSCE physics performance and vice versa. This means that most students whose performance were high in JSCE Basic science also had high performance in SSCE physics while most students' whose performance are low in JSCE Basic science earned low in SSCE physics. The summary of ANOVA for regression showed that the calculated F-value of 184.823 was statistically significant at 0.05 alpha level. The result was further confirmed by the beta value of .531 and associated t-value of 13.595 which was also statistically significant at 0.05 alpha level. The result therefore implies that there is a positive low significant relationship between students' performance in JSCE Basic science and their performance in SSCE Physics. The findings of this study are in agreement with those of Falaye and Afolabi who studies the predictive validity of Osun State Junior Secondary Certificate Examination (JSCE) on the academic performance of the students in the Senior Secondary Certificate Examination (SSCE) and found a low but positive relationship between JSCE and SSCE.

However, a finding discordant with the present one was found by Adeyemi (2008) whose results showed no significant relationship between students' performance in SSCE Physics and JSCE integrated science now Basic Science. The divergent in results may be attributed to the variance in the statistical tools and the area of the study. The present study was analyzed using linear regression while the past was analyzed with Pearson product Moment Correlation. Furthermore, the present study was conducted in Aba Metropolis, Abia State while the past was conducted in Ondo State.

Also, the findings showed that there is a moderate positive relationship between students' performance in JSCE Basic Science and their performance in SSCE Chemistry. The positive relationship means that as performance in JSCE Basic Science increase, there is a corresponding increase in performance in SSCE Chemistry and Vice versa. This shows that most students whose performance were high in JSCE Basic Science also performed highly in SSCE Chemistry while most students' with low performance in JSCE Basic Science also had low performance in SSCE Chemistry. The summary of ANOVA for regression showed that the calculated F-value of 637.968 was statistically significant at 0.05 level of probability. The result was further confirmed by the beta value of 0.759 and the associated t-value of 25.26 which was also significant at 0.05 alpha level. The result therefore implies that students' performance in JSCE Basic Science has a positive moderate significant prediction on their performance in SSCE Chemistry.

The findings of this study is in agreement with those of Ikiroma (2008) who also found out that JSCE integrated science now basic science positive significant relationship with SSCE science subjects has a when he investigated the predictive validity of Junior School Certificate Examination (JSCE) on Senior Secondary School Certificate Examination (SSCE) in Rivers State. Another finding similar to this study is that of Adeyemi (2008) who also found out that performance of students in integrated science now Basic Science has significant influence on chemistry examination. He investigated on the predictive validity of students' integrated science on academic achievement in SSCE science subjects. He used Pearson Product Moment Correlation coefficient

which is significant at 0.05 alpha level. There is similarity of the two findings irrespective of the statistical analysis.

Finally, the result indicates that there is a positive high relationship between performance in JSCE Basic Science and SSCE Biology. The positive relationship means that as performance in JSCE Basic Science increases, there is a corresponding increase in performance in SSCE biology and vice-versa. When ANOVA for regression was applied, F-value of 1202.280 was found to be statistically significant at 0.05 alpha level. The result therefore is that students' performance in JSCE Basic Science has high significant prediction on performance in SSCE Biology.

The findings of the present study agreed with the findings of Adeyemi (2008) and Udoh (2011) who found out significant relationship between students' performance in JSCE integrated science now Basic Science examination and students' performance in SSCE Biology examination. However, the findings negates the findings of Opara and Nwaukwu (2016) who found out that students' JSCE Basic Science scores do not significantly predict their SSCE performance in biology. The divergent in results may be attributed to the variance in the area of the study and the respondents used. The present study was conducted in Aba metropolis of Abia State while the past was conducted in Obio-Akpor Local Government Area of Rivers State.

V. Conclusions

The findings of the study revealed that Basic Science Junior School Certificate Examination significantly predicted physics, chemistry and biology in senior school certificate examination. Interestingly, it is worthy to note that the magnitude of the relationship and percentage of prediction of one variable from another were low between Basic Science and physics, moderate between Basic Science and chemistry and high between Basic Science and Biology.

Implications of the results

The results of the study revealed that students' performance in JSCE Basic Science was statistically significant in predicting their performance in SSCE physics, chemistry and biology. This implies that JSCE Basic Science is a good index for selecting students who are likely to succeed in science subjects. The low and moderate predictions of JSCE Basic Science on SSCE physics and chemistry respectively might be a reflection of poor coverage of physics and chemistry topics and concepts in the Basic Science curriculum. The low and moderate predictive powers also suggest that there may not have been effective teaching and learning of physics and chemistry in the schools which could lead to poor preparation of the students for the examination.

Recommendations

Based on the findings of the study, the following recommendations were made:
1. As a result of low and moderate predictions in some areas, it is therefore recommended that basic science curriculum should have a good coverage of all science subjects.
2. The teachers should always include science practicals in their teaching in order to boost students' interest and understanding in physics and chemistry.

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