INVESTIGATING STUDENTS' KNOWLEDGE OF BASIC SCIENCE POSSESSED AS A PREDICTOR OF SENIOR SECONDARY SCHOOLS STUDENTS' PERFORMANCE IN CHEMISTRY IN NASARAWA STATE

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ABSTRACT

The study investigated the Students' knowledge of Basic Science possessed as a predictor of their Senior Secondary School performance in Chemistry in Nasarawa State, Nigeria. The population of the study comprises of 3280 public Junior Secondary Schools Students who sat for BECE in 2016 and 1624 Public Senior Secondary Schools Students who also sat for Chemistry at SSCE (WAEC). A Correlation research design was used in this study. 265 students out of nine (9) Government Science Secondary Schools were sampled using the purposive sampling technique which formed the sample of the study. Secondary data was used in this study which was collected personally by the researcher from the selected Schools. BECE Basic Science and SSCE Chemistry (WAEC) results were used as instruments for data collection in this study. The data collected were analyzed using linear regression. The results from the data analysis revealed that Students' knowledge of Basic Science at BECE is significant predictor of their performance in Chemistry at SSCE (WAEC). The study also found that Male students' knowledge of Basic Science at BECE is not significant predictor of Male students' performance in Chemistry at SSCE (WAEC). However, it was also found that Female students' knowledge of Basic Science at BECE is significant predictor of Female students' performance in Chemistry at SSCE. It was recommended among others that the teaching and learning of Basic Science at the Junior Secondary School should continue to have regular and proper supervision so as to ensure that students are able to perform better in SSCE Chemistry.

Keywords: Predictor, Gender, students' Performance.

INTRODUCTION

Education can be seen as the power house for the development of a nation. In Nigeria, emphasis has been laid on science and technology education because of domineering power it has on national development. Science and Technology serves as the key to modernizing and developing nations in the world today and have achieved greatness due to the special attention given to science and technology. One of the strategies for enhancing the growth of science and technology in a nation is by paying attention to the training of children at the foundation stage (Jacobson, 2010). The attempt to meet the global demand and sustain the financial crisis prompted Nigerian government to adopt the Universal Basic Education programme in 1999. This

programme comprises of early childhood, primary, junior secondary and other kinds of non-formal education. It is a complete nine-year basic education programme (Okeke, 2012). Chemistry on the other hand is the study of materials substances that exists on earth and elsewhere (Are and Temitope, 2017). Within the context of science education, Chemistry has been identified as a very important school subject and its importance in scientific and technological development of any nation has been widely reported (Adesoji and Olatunbosun, 2008). Junior secondary education in Nigeria provides both vocational and academic programmes for students to enable them acquire knowledge and skills that will help them make appropriate choice of career in the future. At the end of junior secondary education, the Junior Secondary Certificates Examination (JSCE) is conducted as a summative evaluation for the students to determine their level of knowledge and vocational performance. Umar and abubakar, (2017) viewed junior secondary certificate examinations as an examinations enrolled by a candidate in the 3rd year of their junior secondary education in public and private secondary schools in the country. A minimum of credits/passes in five subjects including English and Mathematics qualifies a student who sat for BECE for admission into the senior secondary school programme (Elishama, 2014).

Students' performance in the various subjects in the BECE determines their area of study in the senior secondary school programme. A student who did very well (knowledgeable) in basic science at BECE is expected to cope adequately with the academic challenges of the science subjects in the senior secondary school (Opara & Igeoma, 2017). Current Government policy in Nigeria specifies at the BECE level (lower level) as a prerequisite for admission into SS classes. In the stand of NERDC (2008), with a pass at the BECE, one should be able to determine students that would likely do well at the SSCE. Secondary education is an instrument for national development that fosters the worth and development of the individual for duration given in two stages of junior secondary school and (SSS) respectively. West African Examinations council (WAEC) and NECO independently conduct the senior secondary certificate examination (SSS) in Nigeria. According to National Reseach and Development Council (NERDC, 2008), what the students learn at the JSS level will lay the foundation for the students SSS education and it should be systematically connected to it. It is therefore, assumed that a student who is admitted into the senior secondary school classes possessed the skills and fundamental knowledge to cope with the challenges of schooling at that level.

However, this has not always been the case considering the mass failures 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 and Afolabi, 2015). Several studies have been conducted on predictions of students academic performance; Ugwuda and Abonyi, (2011) observed that the scores of students in JSCE in all the subjects under consideration had low positive correlation with their corresponding scores in SSCE. Onabamiro (2010) established that there was a significant relationship between the overall performance in both examinations, as measured by scores obtained at the JSCE and SSCE, in Epe Local Government Area of Lagos State Nigeria. While Opara and Nwankwu (2016) investigated the predictive validity of junior secondary certificate examination on senior secondary certificate

examination and found positive and low relationship on the predictive validity of junior secondary certificate examination (JSCE) and senior secondary certificate examination (SSCE). For the purpose of comparison with JSCE, WAEC version of the SSCE was used in this study. One of the millennium development goals (MDGs) is gender equality.

As fatokun and Odagboyi (2011) noted, in most societies, the roles of women are knocked to the floor, preventing women from participating in, and benefitting from development efforts. They added that some subjects such as science and mathematics are branded masculine, while others like home economics, secretarial studies are branded feminine. Fasiku (2011) in his comparison of the knowledge of male and female teachers in social studies, conclude that male social studies teachers were very vast in the knowledge of environmental education than female social studies teachers. Gin (2011) observed that in contemporary context, men and women classification is a world where patriarchal values predominate, it is a world where there are general sets of beliefs that women are inferior to men and therefore, the power relations attached to their ideas, and beliefs, give men more power, more opportunities and more conscientious over and above women in the society. Nwona (2013) noted imbalance against women in science, technology and mathematics. These are perceived as masculine subjects.

 Statement of the problem

Results of students' performance in Chemistry for the past few years in Nigeria as obtained from the West African Examination Council (WAEC) Chief Examiner's report also revealed a decline and high failure rate. (About 38.17% of students passed at credit level in 2004, 36.43% passed at credit level in 2005, 40.36% passed in 2006 while less than 26% passed in 2009. The WAEC and National Examination Council (NECO) results released for chemistry in 2010 was also very poor with less than 22% passes at credit level in both examinations) and nose-dived to below 20% in the recent years. The Table below presents the brief picture of performance of students in chemistry in recent years as reported by WAEC chief examiner.

Table 1: Performance in Chemistry Recorded by WAEC

Year	WAEC Percentage Passed At Credit
2004	38.17
2005	36.43
2006	40.36
2007	30.9%
2008	34.7%
2009	Less than 26
2010	Less than 22%

Source: WAEC Chief Examiners Report

However, Most students do not possess a well founded basic framework in which newly acquired concepts can be integrated (Fatokun, 2012). This lack of integration is suspected to be the basis of students' difficulties concerning concept formation and application of acquired knowledge in exercises and practical work (Brandt 2010).

Therefore, Results of students' performance in Chemistry for the past few years in Nasarawa State, Nigeria as obtained from the West African Examination Council (WAEC) Chief Examiner's report also revealed a decline and high failure rate. Thus, there seems to be paucity of studies that have examined the knowledge of Basic Science as predictor of students' performance especially in Chemistry in Nasarawa State. This study seeks to fill this gap.

Objectives of the Study

The objective of this study was to investigate the knowledge of basic science possessed as a predictor to the performance of students in chemistry. The specific objectives of the study are:

1. To determine the extent to which students' knowledge of basic science at JSCE can predict their performance in Chemistry at SSCE.
2. To determine the extent to which male students' knowledge of basic science at JSCE can predict their performance in Chemistry in SSCE.
3. To determine the extent to which female students' knowledge of basic science at JSCE can predict their performance in Chemistry at SSCE.

Research Hypotheses

The following null hypotheses will be tested at the 0.05 level of significance:

$H0_1$: Students' knowledge of Basic Science at JSCE does not predict their performance in Chemistry at SSCE.

$H0_2$: Male students' knowledge of Basic Science at JSCE does not predict their performance in Chemistry at SSCE.

$H0_3$: Female students' knowledge of Basic Science at JSCE does not predict their performance in Chemistry at SSCE.

Significance of the Study

It is expected that this study established the link between the performance of JSCE and the overall performance in SSCE, showing the degree to which the former can influence the latter among students in Nigeria. It is also expected that this study will serve as a guide to, policy makers, ministry of education, curriculum designers and Teachers in Nigeria to identify which element of policy area require urgent modification.

Research Design

Correlation design was used in this study. According to Creswell (2012), correlation is a statistical test to determine the tendency or pattern for two or more variables or two sets of data to vary consistently. In the case of only two variables, this means that two variables share common variance, or they co-vary together. Co-vary means that we can predict a score on one variable with knowledge about the individual's score on another variable Creswell (2012).

The design is suitable because the study is aimed at exploring the relationship between the variables, which are the junior secondary school certificate examination results and the performance at the senior secondary school certificate examination in chemistry. The design is adopted because the study is seeking the predictive knowledge of junior secondary school certificate results in the future performance of students at the senior secondary school certificate Examinations (SSCE) chemistry.

Population of the Study

The population of the study comprises of all the (1624) Science students in public senior Secondary Schools in Nasarawa State, Nigeria who sat for JSCE Basic Science in 2016 and also sat for Chemistry at SSCE in the year 2019. The study focused on Science Secondary Schools because they have all the necessary facilities needed for Basic Science and Chemistry lessons and practical as the time of this study, there were 483 public senior secondary schools.

Sample and Sampling Technique

265 Students out nine (9) Government Science Secondary Schools were sampled using the purposive sampling technique. Purposive sample is a non-probability sample that is selected based on characteristics of a population and the objective of the study (Crossman, 2020). In this case, a homogeneous purposive sample was used in this study. It is types of purposive sample that is selected for having a shared characteristic or set of characteristics (Crossman, 2020). The primary consideration in this type of sampling technique is the researcher's judgment as to who can provide the best information to achieve the objectives of his/her study (Kumar, 2011). As such, 9 secondary schools were chosen across the three (3) senatorial zones in the state and such secondary schools were government-owned science schools with both Junior and Senior Secondary School levels. As at the time of this study there were 265 students whose records at both JSSCE and SSCE were obtained.

Source of Data

The secondary sources of data that is documentary will be used in conducting this study. The data for this study was obtained from the selected Ministry of Education, school authorities/examination office. The data to be collected cover all the aspects of the study variables namely.

Instrument for Data Collections

SSCE and BECE results were used as instruments for data collection in this study.

Validity of the Instrument

The data for this study are the BECE and SSCE results. These data have been standardized by the external examining body and hence can be considered to be valid.

Reliability of the Instrument

The data for this study are the BECE and SSCE results. The instrument is reliable because it has been standardized by external examining body.

Procedure for Data Collection

 An introductory letter was obtained from department of DSE to Ministry of education board and West African examination council (WAEC) requesting for students JSCE and SSCE results for 2016 and 2019 respectively. This served as a means for data collections in this study. The

data were collected for the nine (9) Government Science Secondary Schools involved in this study.

Data Analysis

The data collected for the study was sorted out and analyses using inferential statistical tools. Specifically, linear regression was used to test hypotheses one to three while Pearson Product Moment correlation analysis was used to test hypotheses four and five. The hypotheses will be tested at 0.05 (i.e. 5% level of significance), when the p-value is ≤ 0.05, the null hypothesis is rejected while alternative hypothesis was accepted. However, when the p-value is > 0.05, the null hypothesis was accepted while alternative hypothesis was rejected. The Statistical Package for the Social Sciences (SPSS) version 23 was used to aid the analysis.

RESULTS AND DISCUSSION

Test of Hypotheses
Hypothesis One
Students' knowledge of Basic Science (KBS) at JSCE does not predict their performance in Chemistry at SSCE.

Table 1: Regression Analysis of Knowledge of Basic Science at JSSCE as a Predictor of Students' Performance in Chemistry at SSCE

Variable	Standardized Coefficients Beta	F-value	p-value	Decision
KBS	.160	6.887	.009	Rejected
R-square = 0.026, Adj. R-square = 0.022, t-value = 2.624, p-value = 0.009, alpha=0.05				

Source: Computed using SPSS

Table 4.2 presents the result of regression analysis of the knowledge of basic science at JSSCE as a predictor of students' performance in Chemistry at SSCE. The R-square value (Coefficient of determination) of 0.022 indicates that knowledge of basic science at JSSCE accounted for 2.2% of the variation in students' performance in chemistry at SSCE. The F-value of 6.887 with p-value = 0.009 revealed that the model is adequate. The knowledge of Basic Science (KBS) at JSSCE had a standardized coefficients beta value of 0.160, p = .009. This indicates a significant contribution of the variable in the model, that is, the KBS at JSSCE has a significant positive influence on students' performance in chemistry at SSCE. This implies that KBS at JSSCE is a significant predictor of students' performance in chemistry at SSCE. The null hypothesis is therefore, not rejected.

Null Hypothesis Two
Male students' knowledge of Basic Science at JSCE (MSKBS) does not predict their performance in Chemistry (MPC) at SSCE.

Table 2: Regression Analysis of Male and Female Students' Knowledge of Basic Science at JSSCE as a Predictor of Male Students' Performance in Chemistry at SSCE

Variable	Standardized Coefficients Beta	F-value	p-value	Decision
MSKBS	.127	1.354	.248	Accepted

R-square = 0.016, Adj. R-square = 0.004, t-value = 1.164, p-value = 0.248, alpha=0.05

Source: Computed using SPSS

Table 4.3, the R-square value of 0.016 expressed in percentage as 1.6% indicates that male students' knowledge of Basic Science at JSCE (MSKBS) accounted for 1.6% of the variation in male students' performance in chemistry at SSCE. The F-value = 1.354 with p-value 0.248 indicates that the model is not adequate. The male knowledge of Basic Science (MKBS) at JSSCE had a standardized coefficients beta value of 0.127, p = .248. This indicates an insignificant contribution of the variable in the model, that is, the male students' KBS at JSSCE has an insignificant positive influence on male students' performance in chemistry at SSCE. This implies that male students' KBS at JSSCE is an insignificant predictor of male students' performance in chemistry at SSCE. The null hypothesis was, therefore, accepted.

Null Hypothesis Three

Female students' knowledge of Basic Science (FSKBS) at JSCE does not predict their performance in Chemistry (FSPC) at SSCE.

Table 3: Regression Analysis of Female Students' Knowledge of Basic Science at JSSCE as a Predictor of Fale Students' Performance in Chemistry at SSCE

Variable	Standardized Coefficients Beta	F-value	p-value	Decision
FSKBS	.179	5.894	.0.016	Rejected

R-square = 0.032, Adj. R-square = 0.027, t-value = 2.428, p-value = 0.016, alpha=0.05

Source: Computed using SPSS

Table 4.4 presents the regression analysis which was used in testing hypothesis three. The R-square value 0.027 indicates that 2.7% of the variation in female students' performance in chemistry at SSCE is accounted by their knowledge in Basic Science at JSSCE. The F-value = 5.894 with p-value = 0.016 indicates that the model is adequate. The female students' knowledge of Basic Science at JSSCE at a standardized coefficient of 0.179 with p-value of 0.016 < 0.05. This indicates that the female students' knowledge of Basic Science at JSCE significantly predict their performance in Chemistry at SSCE. Hence, the null hypothesis was rejected.

Summary of Findings

The summary of the major findings are as follows:

i. Students' knowledge of Basic Science at JSCE significantly predict their performance in Chemistry at SSCE

ii. Male students' knowledge of Basic Science at JSCE insignificantly predicts male students' performance in Chemistry at SSCE.

iii. Female students' knowledge of Basic Science at JSCE significantly predicts female students' performance in Chemistry at SSCE.

4.4 Discussion of Findings

The study aimed at investigating the knowledge of basic science possessed by a student as a predictor to the performance of students in chemistry. The findings of the study had revealed that Students' knowledge of Basic Science at JSCE significantly predict their performance in Chemistry at SSCE ($\beta = 16.0\%$). The implication of this finding is that students who performed well in Basic Science at JSSCE are likely to maintain the same level of achievement if they keep working hard in the study and learning of Chemistry concept. The ($\beta = 16.0\%$) implies that 1% unit increase in students' knowledge of Basic Science at JSSCE will lead to a significant increase of 16% increase in the students' performance in Chemistry at SSCE. This finding is in agreement with previous studies by Adeyemi (2008) who conducted a study on predicting students' performance in senior secondary certificate examinations from performance in junior secondary certificates examinations and JSC examinations were a good predictor of performance at SSC examination. Opara, Ijeoma & Stella (2017) also opined that JSCE Basic Science significantly predicted Physics, Chemistry and Biology in Senior School Certificate Examination. The finding of the current study agreed with a study by Dike, and Garba (2017) whose study examined the academic achievement of students in Integrated Science at Junior Secondary School (JSS) as a predictor of their later achievement in Biology at the Senior Secondary School (SSS) and found that achievement of students in Integrated Science significantly predict their later achievement in Biology at SSCE irrespective of their gender. Enemarie, Ajayi, and Ogbeba (2019) had established that achievement of students in Basic Science and Technology significantly predicts their quality of education in Chemistry. However, the findings of the study contradict previous study by Edokpayi and Suleman (2011) investigated students integrated science achievement as predictor of later achievement in Chemistry among secondary School in Zaria and found that academic achievement of students in integrated science in the Junior Secondary School Certificate (JSC) examinations among the selected Secondary schools was a poor predictor of later achievement in chemistry at Senior Secondary School Certificate (SCE) examination.

The finding of the study had also revealed that Male students' knowledge of Basic Science at JSSCE insignificantly predicts the students' performance in Chemistry at SSCE at ($\beta = 12.7\%$). The implication of this finding is that male students' who had good knowledge of Basic Science at JSSCE may not likely maintain the same in Chemistry at SSCE. The ($\beta = 12.7\%$) implies that 1% increase in male knowledge of Basic Science may likely increase their performance in Chemistry at SSCE by 12.7% though insignificant. This finding is in agreement with a finding

from a previous study by Edokpayi and Suleman (2011) investigated students integrated science achievement as predictor of later achievement in Chemistry in Zaria metropolis and found that there is a poor linear relationship between the male student academic achievements in the JSCE and their achievements in chemistry in the SSCE. However, the finding of this study disagreed with findings from previous study conducted by Enemarie, Ajayi, and Ogbeba (2018) who investigated whether students' achievement in Basic Science in Basic Education Certificate Examination (BECE) is a predictor of their performance in Biology in Senior Secondary Certificate Examination (SSCE) and found that the achievement of male students in Basic Science in BECE significantly predicts their performance in Biology in SSCE. The finding of the current study also disagreed with a finding from a study by Dike and Garba (2017) who established that male students' academic achievements in Integrated Science significantly predict their achievements in Biology.

The finding of the study revealed that Female students' knowledge of Basic Science at JSSCE significantly predict the students' performance in Chemistry at SSCE (($\beta = 17.9\%$). The implication of this finding is that female students who had good knowledge of Basic Science at JSSCE would likely perform better in Chemistry at SSCE. The ($\beta = 17.9\%$)implies that 1% increase in female students' knowledge of Basic Science tend to significantly increase their performance in Chemistry by 17.9%. This finding is in agreement with previous study by Enemarie, Ajayi and Ogbeba (2018) who investigated whether students' achievement in Basic Science in Basic Education Certificate Examination (BECE) is a predictor of their performance in Biology in Senior Secondary Certificate Examination (SSCE) and found that achievement of female students in Basic Science in BECE significantly predicts their performance in Biology in SSCE. Dike and Garba (2017) also opined that female students' academic achievements in Integrated Science significantly predict their achievements in Biology. However, the finding of the study contradicts previous study by Edokpayi and Suleman (2011) whose study has established that the existence of poor linear relationship between the female student academic achievements in the JSCE and their achievements in chemistry in the SSCE.

CONCLUSION

The study investigated the knowledge of Basic Science possessed as a predictor of Senior Secondary School Students' performance in Chemistry in Nasarawa State, Nigeria. the study was guided by five research objectives. Based on the finding of the study that Students' knowledge of Basic Science at JSCE significantly predicts their performance in Chemistry at SSCE, this study concluded that knowledge of Basic Science possessed is a significant predictor of Senior Secondary School Students' performance in Chemistry in Nasarawa State, Nigeria. The study also concludes that knowledge of Basic Science possessed by male students' is an insignificant predictor of their performance in Chemistry at SSCE. However, knowledge of Basic Science possessed by female students' is a significant predictor of their performance in Chemistry in SSCE.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were put forward:

i. Based on the findings, it was recommended that the teaching of Basic Science at the Junior Secondary School should continue to be emphasized, if Nasarawa State is to be recognized among the states to produce scientists for the future technological development of Nigeria.

ii. It was also recommended among others that placement of students into science classes in senior secondary level should be strictly dependent on their achievement in Basic Science and Technology so as to guarantee acquisition of high quality science education at the senior secondary school.

iii. There should be a strong and reliable counseling unit in the schools with counselors to help handle the issue of placement in case any issue of interest arises either from the parent or student.

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