BASIC SCIENCE AS A PREDICTOR OF STUDENTS' PERFORMANCE IN SENIOR SECONDARY SCHOOL SCIENCE SUBJECTS IN EKITI STATE, NIGERIA

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Abstract

This research work was a predictive study under correlation study. The study examines the relationship that existed between students' performance in Basic Science at the Junior Secondary School Examination (2008) and their later performances in Senior School Science Subjects Examination in (2011). The target population for the study was all the junior and Senior Secondary Schools in Ekiti State, Nigeria. Random sampling techniques was used to select twenty-five (25) Junior and Senior Secondary Schools between 2008 and 2011, the instrument used in the study was the Junior Secondary School Certificate Examination (JSCE) result (2008) Basic Science and Senior School Certificate Examination (SSCE) results in Biology, Chemistry and Physics (2012). Twelve hypotheses were raised, and a correlation analysis was done to establish the relationship between students' scores in Basic Science and the Senior School Science subjects using spearman's order rank correlation efficient (rho) at 0.05 an alpha level of significance. The finding showed that the results of students in Basic Science and Senior School Sciences showed a positive significant correlation. And average mean indices showed that the students performed above average in both Basic Science in the Junior Secondary School and the Senior School Science subjects. It was also showed that Biology has least mean indices and that students performed better in Physics than in Biology and Chemistry, it was also discovered that the average mean indices for female students was a little bit higher than that of male students and that students performed better without considering the gender differences. Based on these findings, it was recommended that the placements of students in science class at the Senior Secondary School should be based on the students' performance in Basic Science at the Junior Secondary School; and that students should be more serious about Biology and not to see it as the simplest science subject that they can easily pass; it was also recommended that male students should not relent efforts in science subjects but put more efforts and that female students should sustain their good performance in science subjects moreover it was recommended that some of the existing single – sex schools in the country be converted to co-educational schools to raise the trends of students performances in science subjects.

Key words: Basic Science, Predictor, Students, Performance, Sciences

Introduction

Science plays an indispensable role in the national development of a country. A country can only achieve a position of eminence only through scientific approach to national development. Science is a body of knowledge, a way of thinking in pursuit of an understanding of nature, (Abimbola and Omosewo, 2006). Science is the process of gathering, comparing and evaluating proposed models against observables (Wikipedia, 2010). Science as an organized discipline may be classified into two broad areas: the pure science and the applied science usually referred to as technology (Daramola 2001). Pure science includes Biology, Chemistry, and Physics. The aims and objectives of the National policy on education (2004 P.18) are to develop students technologically. This prompts the offering of science subjects at the secondary schools. There are two sections in secondary education in Nigeria. These are the Junior and the Senior Secondary.

Basic science is offered at the Junior Secondary School while Biology, Chemistry and Physics are offered as science subjects in the Senior Secondary School. Wikipedia (2011), the free encyclopaedia defined Basic Science as course with merged topics like Biology, Chemistry and Physics, therefore the teaching of Basic Science at the Junior School is to produce the scientifically literate children in terms of the unity of sciences.

Biology is study of life. It is the science that deals with living things. This subject is broadly divided into zoology, the study of animal life and botany, the study of plant life. In support of this, Wikipedia the free encyclopaedia defined biology as a natural science concerned with the study of life and living organisms, including their structures. Sarojini (2005) defined Biology as the study of living things interacting with their non-living components. The importance of Biology therefore, cannot be over emphasized. Through the knowledge of Biology, students are able to understand more clearly, factors affecting our survival such as; drugs, food production, shelter, sanitation and comfort.

Chemistry is a branch of science which deals with the study of the structure and composition of matter (Bajah, Teibo, Onwu, & Obikwere (2011). Chemistry is introduced into the curriculum content of secondary school because of its educational value and relevance to the need of the individual learner and society as a whole. Chemistry affects individual's life in the area of product of industrial processes. For instance, in the food industry, people in both advanced developing and undeveloped countries depend on chemicals such as pesticides to eradicate pests affecting good production of crops. Fertilizers are used to augment the fertility of soil and boost crops production Most of these chemicals

are products of application of chemical science. So also, chemicals known as preservatives are used to prevent action of bacteria on food while others are used in form of drugs to prevent and cure sicknesses and diseases.

Daramola defines physics as the study of the relationship between matter and energy in all its ramifications. Physics is inevitable to social growth because it has contributed to the discovery of many amenities such as hydroelectric power, which makes life in rural and urban areas more comfortable through the supply of electricity.

In the new Basic Science curriculum 2008/2009, Basic Science is seen as a multi-disciplinary programme that touches the boundary of various aspects of science such as Biology, Chemistry, Physics, Geography, Agricultural Science and Information Communication Technology (ICT). Of all these science subjects, Biology, Chemistry and Physics take the greater percentages of the topics in Basic Science as seen in the Table 1.

Table 1. *Subjects Table: Distribution in 9 years Basic Education in Basic Science for Upper Basic Education 2006/2007*

Subject	No of Topics	Percentages
Biology	26	39%
Chemistry	6	9%
Physics	18	27%
Others Subjects like Agricultural Science, Geography, Health Science And Technology	17	25%

Source: Federal Republic of Nigeria (National Policy on Education, 2009).

Adeyemi (2008) conducted a study on predicting students' performance in Senior Secondary School Examination from their performance in Junior Secondary Certificate Examination in Ondo-State. The findings revealed that the J.S.C.E Examination were a good predictor of performance at SSCE since the performance level was generally low in both examinations. Edokpayi and Suleman (2011) investigated students' Basic Science performance as predictor of later performance in chemistry among Secondary Schools in Zaria Metropolis. The results of the investigation revealed that the academic performance of students' in Basic Science in the Junior Secondary School Certificate Examination among the selected secondary schools was a poor predictor of later performance in chemistry at Senior Secondary Certificate Examination. Osokoya (1999) carried out a study on students' performance in Basic Science as a predictor of performance in Biology, Chemistry and Physics in Oyo State. It was revealed that Basic Science is a powerful predictor of students' performance in the science subjects especially Biology.

Many scholars and educators, among which are Omotola (2004), Thompson (2004) Abimbola (2004), Omosewo (2008) opined that there are some factors influencing students' performances in science subjects. These factors according to the scholars include laboratory equipment and materials, teacher's factors, student's factors, and parent's factors. Omotola (2004) is of the opinion that most schools are without laboratory and a few that has one are without equipment in them or poorly equipped. This is in support of Thompson (2004) who also discovered that in schools where there are laboratories, it is only for the science subjects at the senior classes and not for Basic Science.   Abimbola (2004) opined that teaching is seen as the process of facilitating students' learning through proper management of interrelationships among students' interests, contents, methods and teaching materials by the teacher. Omosewo (2008) asserted that the efficiency of any institution depends to a large extent on the academic competence of the teaching staff and that no educational system can rise above the quality of its teachers.

Student's factors identified are ranging from students' poor attitudes to science and students' misconceptions, Ogunleye (2007). Students' peer group according to Falaye (2007) may have either positive or negative impact on the students' academic performance. As a communication barrier, Ebenezer (2011) identified language as one of the factors contributing to low performance of in physics as many students cannot express themselves fluently in English and with the general mentality before now, that mastery of English language is not too necessary for the study of science subjects. According to Thompson (2004) most parents could appreciate the need for education but not qualitative education. Some parents don't appreciate the need for providing the necessary materials like textbooks, writing materials, to mention a few for effective learning of the subjects to their wards.

Many researcher have carried out studies on the influence of gender on students performances in sciences among which are Owolabi and Bandele (2002), while working on gender issues in error analysis of physics practical of pre-science students in a college of Education in Nigeria, found out that there were differences in nearly all the errors committed by boys over three consecutive years as against girls where there were no much errors on their ability or effectiveness in the laboratory. Adebayo (2002) examined the effect of concept mapping on Junior Secondary performance of male and female students. The experimental group comprising of sixty-seven (67) students (45 male and 22 female). The result of the study showed that, male students performed better on the items than the female students. However, in a study that was conducted by Salman (2004) to analyse the technique used by the male or female Secondary School students to solve simultaneous linear equations by

graphical method. The study also compared the general performance of male and female students using the scores obtained from the test administered to them. One hundred and twenty (120) Junior Secondary School (JSS) III students from four secondary schools in Ilorin West Local Government Area of Kwara State were selected for the study. The result revealed that both male and female Junior Secondary III Students have difficulty with the graphical method of solving simultaneous linear equation.

Research Methodology

This is a predictive study under the descriptive research types. Performance in Junior School Certificate Examination (J.S.C.E) in basic science is the predictor (independent) variable, while performance in biology, chemistry and physics at the senior secondary level are the dependent variables. The study is longitudinal in nature; in that the same set of students who sat for the Junior School Certificate Examination in Basic Science were followed up to senior secondary school level and their grades in biology, chemistry and physics were collected.

All the students in junior and senior secondary schools in Ekiti state formed the target population for the study. Twenty-five secondary schools were selected using random sampling techniques based on the 3 senatorial districts in the state. Schools were randomly selected from each of the senatorial districts making a total of 500 students.

The instruments from which data was collected for this study was the results from the Junior School Certificate Examination (JSCE) in Basic Science conducted by the State Ministry of Education (2008) and the Senior School Certificate examination (SSCE) in Biology, Chemistry and Physics conducted by WAEC (2011).

Data Analysis and Results

The statistical analysis used for the study was descriptive statistics of means and standard deviation. Thereafter, a correlation analysis was done to establish the relationship between students' scores in basic science and senior school sciences to ascertain whether any significant relationship exist at 0.05 an alpha level of significance. The grading systems provided by the West African Examination Council were used and the aggregate scores were obtained for all the students in all the subjects and since the raw scores were not used, the researcher made use of Spearman's Rank Correlation Coefficient analysis. The data analysis and the results are presented in Tables 2-14.

Hypothesis 1: There is no significant relationship between students' performance in Basic Science and Senior School Sciences

Table 2. *Correlation Matrix Showing Students' Performance in Basic Science and Senior School Science Subjects*

	Basic Science	Biology	Chemistry	Physics
Basic Science	1.000	.116 (P=.000)	.164 (P=.000)	.260 (P=.000)
Biology		1.000	.368 (P=.000)	.285 (P=.000)
Chemistry			1.000	.352 (P=.000)
Physics				1.000

P<0.05, N= 500

Table 2 showed that there is a significant relationship between the performance of subjects in Basic Science and Biology (r=.116, P<0.05). Similarly, there exists a significant relationship between students' performance in Basic Science and chemistry (r=.164, P<0.05), Basic science and Physics (r=.368, P<0.05). Hence, hypothesis 1 was rejected.

Hypothesis 2: There is no significant relationship between students' performance in Basic Science and Senior School Sciences

Table 3. *Correlation Matrix Showing Students' Performance in Basic Science and Senior School Science Subjects*

	Basic Science	Biology	Chemistry	Physics
Basic Science	1.000	.113 (P=.000)	.183 (P=.003)	.283 (P=.000)
Biology		1.000	.311 (P=.000)	.247 (P=.000)
Chemistry			1.000	.281 (P=.000)
Physics				1.000

P<0.05, N = 235

Male students' performance in Basic Science correlates significantly with their performance in Chemistry (r = .183, P<0.05) and Physics (r = .283, P<0.05) at 0.05 an alpha level. However, the relationship between male students' performance in Basic Science and Biology is not statistically significant at 0.05 level (r = .113, P>0.05). Hence hypothesis 2 was not rejected.

Hypothesis 3: There is no significant relationship between female Students' performance in Basic Science and Senior School Sciences.

Table 4. *Matrix Showing Female Students' Performance in Basic Science and Senior Science Subject*

	Basic Science	Biology	Chemistry	Physics
Basic Science	1.000	.095 (P=.149)	.124 (P=.059)	.217 (P=.001)
Biology		1.000	.423 (P=.000)	.286 (P=.000)
Chemistry			1.000	.410 (P=.000)
Physics				1.000

P<0.05, N = 235

Table 4 revealed that there is a significant positive correlation between female students' performance in Basic Science and Physics at 0.05 an alpha level (r =.217, P<0.05). Female students' performance in biology correlates significantly with their performance in Chemistry. However, students' performance in Basic Science does not correlates significantly with their performance in Biology (r= .095, P>0.05) and Chemistry (r = .124, P>0.05) in each case. Hence hypothesis 3 was not rejected.

Hypothesis 4: There is no significant relationship between students' performance in Basic Science and Biology.

Table 5. *Correlation Summary of Students' Performance in Basic Science and Biology*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	500	1.85	0.48	0.116	0.000
Biology	500	1.64	0.65		

P<0.05

The null hypothesis is rejected (r= 0.116, P<0.05). It implies that there is a significant relationship between students' performance in Basic Science and Biology.

Hypothesis 5: There is no significant relationship between students' performance in Basic Science and Chemistry.

Table 6. *Correlation of Students' Performance in Basic Science and Chemistry*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	500	1.85	0.48	0.164	0.000
Chemistry	500	1.72	0.72		

P<0.05

Table 6 showed that there is a significant relationship between students' performance in Basic Science and Chemistry (r = 0.164, P<0.05). Therefore, hypothesis 5 was rejected.

Hypothesis 6: There is no significant relationship between students' performance in Basic Science and Physics.

Table 7. *Correlation of Students' Performance in Basic Science and Physics*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	500	1.85	0.48	0.260	0.000
Physics	500	2.15	0.76		

P<0.05

Table 7 revealed that there exists a significant relationship between students' performance in Basic Science and Physics (r = 0.260, P<0.05). This implies that hypothesis 6 was rejected.

Hypothesis 7: There is no significant relationship between male students' performances in Basic science and biology.

Table 8. *Correlation Showing the Performance of Male Students in Basic Science and Biology*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	265	1.82	0.49	0.114	0.066
Biology	265	1.58	0.63		

P<0.05

Table 8 showed that there is no significant relationship between male students' performance in Basic Science and Biology (r = 0.114, P<0.05). The hypothesis 7 was rejected.

Hypothesis 8: There is no significant relationship between male students' performances in Basic Science and Chemistry

Table 9. *Correlation Showing the Performances of Male Students in Basic Science and Chemistry*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	265	1.82	0.49	0.183	0.003
Chemistry	265	1.66	0.72		

P<0.05

There is significant relationship between male students' performance in Basic Science and Chemistry (r = 0.183, P<0.05). Therefore, hypothesis 8 was rejected

Hypothesis 9: There is no significant relationship between male students' performance in Basic Science and Physics.

Table 10. *Correlation shown the Performance of Male Students in Basic Science and Physics*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	265	1.82	0.49	0.283	0.000
Physics	265	2.00	0.73		

P<0.05

Table 10 showed that there is a significant relationship between male students' performance in Basic Science and Physics (r = 0.283, P<0.05). Hence, hypothesis 9 was rejected.

Hypothesis 10: There is no significant relationship between male students' performance in Basic Science and Biology.

Table 11. *Correlation showing the Performance of Male Students in Basic Science and Biology*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	265	1.89	0.46	0.095	0.149
Biology	232	1.771	0.65		

P<0.05

Table 11 shows that there is a significant relationship between male students' performance in Basic Science and Biology (r = 0.095, P<0.05). Hence, hypothesis 10 was not rejected.

Hypothesis 11: There is no significant relationship between female students' performance in Basic Science and Chemistry.

Table 12. *Correlation Summary of Female Students' Performance in Basic Science and Chemistry*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	265	1.89	0.46	0.124	0.059
Chemistry	232	1.78	0.71		

P<0.05

Table 12 shows that there is a significant relationship between female students' performance in Basic Science and Chemistry (r = 0.095, P<0.05). Therefore, hypothesis 11 was not rejected.

Hypothesis 12: There is no significant relationship between male students' performance in Basic Science and Physics.

Table 13. *Correlation Summary of Female Students' Performances in Basic Sciences and Physics*

Variables	No	Mean	SD	r-cal	p-value
Basic Science	265	1.89	0.46	0.127	0.001
Physics	265	2.31	0.75		

P<0.05

The result showed that there is a significant relationship between female students' performance in Basic Science and Physics (r = 0.202, P<0.05). Therefore, hypothesis 12 was rejected.

Table 14. *The Mean Values of the JSCE Basic Science Scores and WASCE Biology, Chemistry and Physics Scores*

Sex	No. of Candidate	Basic Science	Biology	Chemistry	Physics
Male	265	1.82	1.58	1.66	2.00
Female	235	1.89	1.71	1.78	2.31
Overall	500	1.85	1.64	1.72	2.15

The overall mean indices for the Basic Science showed that the students performed above average in Basic Science at the Junior Secondary School, Examination in 2008. The overall mean indices for the Basic Science are 1.85 when the highest scores obtained, was 3 and the least was 0. The mean value for males and females were 1.82 and 1.89 respectively which showed that the males and females had scores ranging between credit and passes in

Basic Science. Also, in the Senior school sciences, the overall mean indices in 2011 which were 1.64, 1.72 and 2.15 showed that the students performed above average when the highest scores obtained was 3 and the least was 0. The mean value for males and females in Biology was 1.58 and 1.71, the chemistry was 1.66 and 1.78, and Physics was 2.00 and 2.31 respectively. These showed that the males and the females also had scores between credit and pass in all the Senior School sciences. This indicates that the performance of students in Basic Science at Junior Secondary School can be used to predict the performance of students in the senior school sciences.

Summary of the Findings

The following are the major findings:

1. There was a significant relationship between the performances of students in Basic Science and Biology. Similarly, there existed a significant relationship between students' performance in Basic Science and Chemistry.

2. Male students' performance in Basic Science correlated significantly with their performances in chemistry. However, the relationship between male students' performance in Basic Science and Biology did not correlate.

3. There was a significant correlation between female students' performance in Basic Science and Physics. However, female students' performance is Basic Science did not correlate significantly with their performance in Biology.

4. There was a significant correlation between students' performance in Basic Science and Biology without giving consideration to gender differences.

5. There was a significant correlation between students' performance in Basic Science and Chemistry without giving consideration to gender differences.

6. There was a significant correlation between students' performance in Basic Science and Physics without giving consideration to gender differences.

7. Male students' performance in Basic Science did not correlate with their performance in Biology.

8. Male students' performance in Basic Science did not correlate with their performance in Chemistry.

9. There was a significant correlation between male students' performances in Basic Science and Physics.

10. Female students' performance in Basic Science did not correlate with their performances in Biology.

11. Female students' performance in Basic Science did not correlate with their performances in Chemistry.

12. There was a significant correlation between female students' performance in Basic Science and Physics.

Discussion and Conclusion

The finding of this study indicated that there was positive significant correlation between Basic Science and the senior school science subjects. This is in line with the result of Adeyemi (2008) who conducted a study on prediction of students' performance in Senior Secondary School Examination from their performance in Junior Secondary Certificate Examination in Ondo-State and found that the J.S.C.E Examination were a good predictor of performance at SSCE since the performance level was generally low in both examinations. This also corroborate with the findings of Osokoya (1999) who carried out a study on students' performance in Basic Science as a predictor of performance in Biology, Chemistry and Physics in Oyo State and results revealed that Basic Science is a powerful predictor of students' performance in the science subjects especially Biology.

However, the result of this study is against the work of Edokpayi and Suleman (2011) who examined students' Basic Science performance as predictor of later performance in chemistry among Secondary Schools in Zaria Metropolis, and have the results of their investigation revealed that the academic performance of students' in Basic Science in the Junior Secondary School Certificate Examination among the selected secondary schools was a poor predictor of later performance in chemistry at Senior Secondary Certificate Examination.

This study also revealed that male and female student performed averagely in both Junior School Certificate and the Senior School Certificate Examinations which is in line with Adebayo (2002) who examined the effect of concept mapping on Junior Secondary performance of male and female students and has the results of the study showed that, male students performed better on the items than the female students. However, in a study that was conducted by Salman (2004) to analyse the technique used by the male or female Secondary School students to solve simultaneous linear equations by graphical method and compared the general performance of male and female students using the scores obtained from the test administered to them revealed that both male and female Junior Secondary III Students have difficulty with the graphical method of solving simultaneous linear equation.

The study concluded that students performed better in Physics than in Biology and Chemistry and that Biology had the least mark of all Science subjects. So also, the overall performance showed that female students performed better than the male students in all the science subjects. These implied that the results of students in Basic Science could be used to predict their performances in Senior School Sciences.

RECOMMENDATIONS

Based on the research finding, the following recommendations were made:

1. Teachers of Basic Science should be laying emphasis on the important of good performance in Basic Science as in determines the student's performance in Senior School Sciences. They should also make their teaching more interesting to arouse the student's interest in studying science right from junior school. This includes organizing field trip and excursion for the students

2. Male students should take Biology serious and not to see it as a simple science subject that they can easily pass.

3. Teacher should help Female Students' to improve on their performance in Biology and Chemistry through proper monitoring encouragement and correction.

4. The students should be more serious in their performance in Basic Science so as to perform better in Biology at the Senior School level.

5. The students should offer Chemistry in Science Class should have good grade in Basic Science.

6. The students who should offer physics in Senior School level should have good grade in Basic Science at the Junior Secondary School level.

7. Teacher should help the Male students to improve on their performance in Biology through proper monitoring, supervision and discipline.

8. The placement of male students in senior science class to offer chemistry should be based on their performance in Basic Science.

9. The placement of Male students in science class to offer physics should be based on their performance in Basic Science.

10. Female students should also take Biology Serious and not to see it as simple science subjects which can easily be passed.

11. Female students should put more efforts on their performance in Chemistry and should not to see it as a difficult subject that they cannot pass.

12. The placement of female students in Senior Secondary School to offer physics should be based on their performance in Basic Science.

13. It was discovered that the performance of subjects in physics was better than that of Biology and Chemistry, based on this finding; it was recommended that the Government and the school Authorities should always make available the necessary materials for these subjects; (Chemistry & Biology) that requires more consumables for their practical so that the performance of subjects in these subjects could be improved.

14. In course of this study, researcher made use of twenty-five schools with more than three thousand students; before the five hundred numbers of students needed for the study could be completed. This showed that there was low enrolment in science subjects in the state. It was therefore recommended that students should be encouraged by the teachers, parents and the Government to study science subjects.

15. It was discovered that female students performed better than male students. It was therefore recommended that Male students should not relent their effort in science subjects but should put more efforts and that Female students should sustain their good performance in Science subjects.

16. When the performance of subjects in Basic Science and Biology, Basic Science and Chemistry was correlated without considering the gender differences there was a significant relationship between their performances. Based on this finding, it was recommended that some of the existing single-sex schools in the country be converted to co-educational schools to raise the trends of subjects' performances in Science Subjects.

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