
ERROR COMMITTED BY BIOLOGY STUDENTS AND THEIR ACADEMIC ACHIEVEMENT AT THE SENIOR SECONDARY SCHOOLS ZARIA.

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ABSTRACT

This paper investigated the relationship between frequencies of errors committed and academic achievement by science and non-science Biology students at the Senior Secondary School Certificate Examination in Zaria metropolis. Descriptive research design, survey method was employed. A total of 684 SS III students randomly selected from Secondary Schools in Zaria Educational Zone were the sample for the study. The instrument used for data collection was Biology Test for Identification of Students Error Types (BTISET). This was adopted from WAEC 2005 May/June Biology Essay Questions and the marking scheme. A model for the classification of errors committed by students into types as proposed by Suydam (1985) was also employed. Data obtained were analyzed using t-test statistics. Findings showed that there is a significant difference in academic achievement between science and the non-science students with the science students committing fewer errors and achieving higher. It was recommended based on the findings that placement of students into science and non-science disciplines should be as prescribed by the Federal Republic of Nigeria (2004).

INTRODUCTION

The importance of science and technology to a nation cannot be over-emphasized. To lend credence to this, Okebukola (2008) described education as the antidote to poverty, ignorance and the key for unlocking natural resources. He emphasized that education is the main plank for economic development. As such no nation derives accelerated development without huge investment in education. This underscores the reason why the Federal Government of Nigeria in its National Policy on Education (FRN 2004) emphasized the teaching of science at the grassroots (i.e. Primary and Secondary School Levels) as a platform for scientific and technological emancipation and development of our nation.

To monitor the attainment of the objectives of the Nigerian educational system a focus must be given

to the evaluation aspects of the curriculum. Wasagu (2000) defined curriculum as the total spectrum of content, resources, materials, and methods of teaching through which the purposes of education are achieved. Ben-Yunusa (2000) sees curriculum as a process through which total experiences are offered to a learner with predetermined objectives. He further stressed the importance of evaluation of curriculum. Mustapha (2005) defined evaluation as an essential aspect of education because it serves as monitoring device for finding out what learning objectives of a curriculum have been met and by extension what total national educational goals and objectives have been attained. He further stressed that, the progress of any educational system is anchored on evaluation which is inherent in curriculum. Evaluation therefore can be a kind of device to gauge or measure the quality and quantity

of learning that has taken place and how far the attainment of the stated national objectives are being met.

The West African Examination Council (WAEC) and the National Examination Council (NECO) are institutions the Nigerian government ratified their treaty or set up respectively to help, monitor through evaluation the quality of coverage of the content of the Senior Secondary School curriculum. This evaluation process is further certificated by these examining bodies. The statistics of grades

obtained by candidates in the WAEC Biology Examination in recent years have not been encouraging, as presented in **Table 1**. The statistics of performance in Biology May/June Senior Secondary Certificate Examination (SSCE) from 2007 – 2012 i.e. six years period revealed poor percentage score at credit level in grades 1 – 6. The highlight of the performance is as indicated in **Table 1**:

Table 1: Statistics of Biology Results in May/June SSCE (2007 – 2012).

Year	Total Entry	Total passes with Merits/Credits and Above	% Grades with Merits/Credit and above
2007	1,261,971	421,120	33.37
2008	1,285,048	436,145	33.94
2009	1,364,655	390,019	28.58
2010	1325408	1300418	49.64
2011	1532770	1505199	38.49
2012	1687788	1646150	35.66

Sources: WAEC Annual Reports (2007 – 2009).

From **Table 1**: the performance in Biology within a period of 3 years under review has been abysmal. Despite the increasing number of candidates, the percentage of candidates with grade levels in merits, credits and above has fallen below 45% for the whole years under review. This is so for Biology because most candidates that register for it do not necessarily need it for further studies, (Olatoye, 2004). There is no justification for its popularity because Biology is not a core subjects in the Senior Secondary School curriculum. However, because of the stipulation that students must offer one of the basic science subjects (Biology, Chemistry & Physics) irrespective of the disciplines (science or non-science), it is preferred by most students. This is because it is perceived “cheaper” than the other two (Soyinbo, 1982). This may not be so and could be a pitfall for commission of errors.

If **Table 1** is examined critically in terms of the present day realities of our manpower needs and the future projections, it calls for a rethink. For example, most of the Nigerian governments (past and present) have been pursuing programmes aimed at fast-tacking socio-economic development of the country. To attain this level education has a prominent role to play. According to Okebukola (2008) education has a role to play in the form of Higher Education Participation Rate (HEPR). He further said that the HEPR is the proportion of eligible population who has access to higher education and it provides high level human resources to develop the economy and ensuring rapid societal transportation. Rapid social and economic development depends on the higher education opportunities given to citizens.

This incidentally requires the provision by government to its learning populace a sound

basic and secondary education as a precursor to the higher education. However, this is far from being achieved because there is the prevalence of deficiency in the presentation of answers to Biology Essay questions at SSCE level by candidates. This could be due to their inability to express their knowledge or skill effectively to the examiner or interpret or respond to the questions as demanded. This leads to the commission of errors and where the frequencies is high could affect the quality of the pass mark. Akpan (1989) observed that teachers also have a role to play in curbing this and need to acquaint the students with the correct ways of presenting answers to the questions they come across in examinations. However, teachers seem not to strategy's their students on these.

Similarly, one of the stipulations of the National Policy on Education (FRN 2004) is that the streaming of students from the Junior Secondary Schools (JSS III) into the Senior Secondary Schools SS I shall be based on result of test conducted to determine academic ability, aptitude and vocational interest. It further classifies the streaming of the products of JSS III through appropriate placements into different Senior Secondary Schools thus;

- The Senior Secondary School
60%
- The Technical College
20%
- The Vocational Training Centre
10%
- Apprenticeship scheme
10%

However, what is being practiced in the transition from JSS III to SS I in most schools in Nigeria is an almost 100% transition and without regard for the appropriate placement into the different Senior Secondary Schools (SS I) types

named above. This could have severe consequence on the results or performance of some of the students. Similarly, the placement into the different disciplines/subject specialization i.e. (Art class, science and social science classes) based on the outcome of the JSS certificate Examination (JSSCE) (as prescribed by the National Policy on Education) is often neglected. Students are placed in certain classes against the outcome of their performance or ability, aptitude and vocational interest.

The major grouping or distribution of Senior Secondary School Students into disciplines is science or non- science basis. Errors committed by students in Biology theory paper at SSCE in each of these groups (science or non-science) may be similar or not since there is differences in aptitude and vocational interests. Analysis of the errors committed by students could be obtained through careful studying in order to make inferences.

The study therefore focused on identification of errors, classification of errors into types using the Suydam (1985) model and the frequencies of the error types. Result of the frequencies of the error types was matched against academic achievements of the two groups (science and non-science). The study aimed at finding answers to the following research questions

1. What are the frequencies of the different error types committed by the science and the non-science students in Biology at SSCE?
2. What are the effects of the frequencies of the errors on achievements between the science and the non-science students at the SSCE?

HYPOTHESES

Two null hypotheses were formulated and tested at 0.05 levels of significance.

Ho1: There is no significant difference in the frequencies of the error types committed by both the science and the non-science Biology students.

Ho2: There is no significant difference in the mean score of academic achievement in BTISET between science and non-science Biology students.

METHODOLOGY

To aid the accomplishment of the set objectives descriptive non-experimental research design and particularly survey technique was employed.

The population of the study comprised all the SS III students in Zaria Educational Zone of Kaduna State offering Biology. The average chronological age of the students is 17½ years. As at the time of the study these were 18 public Senior Secondary Schools supervised by the Zaria Zonal Inspectorate Division of the Kaduna State Ministry of Education. Eight schools were stratified and randomly sampled from the eighteen schools on the basis of sex of students, type of programmes run by the school i.e. (science and non-science). The sample comprises of two boys and two girls schools from each of the two Local Governments i.e. (Sabon gari and Zaria) under the Zonal Inspectorate. The sample population comprised of 684 sorted into 342 science and non-science study subjects respectively.

The instrument used for data collection was Biology Test for Identification of Students Error Types (BTISET) adopted from WAEC 2012 May/June (Biology Essay) question and the marking scheme. The suydam model of classification was also used for the classification of the identified error types. This instrument was not validated because it was thought to have been validated by the WAEC. However, it's the test item consisted of two parts; part one comprised of

four questions and of which two questions must be answered. The part two consisted of two questions out of which one must be answered. This is the prescribed WAEC standard. These questions in both part one and two comprised of short answer questions and are from different topics across the SSCE Biology syllabus. These topics included; transportation systems, skeletal and supporting systems, nutrition in organisms and sexual and asexual reproduction in organisms. Other questions in the part two included Genetics and Ecology. Each question carries 20 marks with a total of 60 marks.

The test item was administered to each of the study samples directly (face contact) by the researcher assisted by a research assistant in the month of April few days to the commencement of the WAEC Exams in order to ensure their readiness and wider scope of the coverage of the syllabus. One hour thirty minutes was given to each respondent and they were not allowed to interact throughout the period the test lasted. The researcher and the research assistant supervised the subjects to ensure that there was no interaction among subjects throughout the test lasted. At the end of the administration of the tests, the answer scripts and the test question papers were collected; hence 100% retrieval.

After all the schools have each taken their tests, the answer scripts were later marked by the researcher using the marking scheme (WAEC). A colleague of the researcher and also a Biology teacher was asked to assist in checking the scripts to ensure that mistakes were not made during the marking, scoring and collation of the scores.

To determine the type of errors made, each of the scripts was taken and each wrong answer provided was analyzed in order to probe the type of error made was identified from the responses and classified into the 5 criteria items as well as the frequencies. The keys for the

interpretation of the error types, formats for analyzing the frequencies of error types and

summation of the frequencies are given in figure 1-3

Key for the interpretation of the error types

S/N	ERROR TYPES
1.	Type I error: Random errors.
2.	Type II error: Errors related to sequence of steps within procedures.
3.	Type III error: Errors related to conceptual learning.
4.	Type IV error: Errors related to selection of information or procedure.
5.	Type V error: Errors related to recording of work.

RESULTS

Research question 1

What are the frequencies of the different error types committed by the science and the non-science students in Biology at SSCE?

Null hypothesis 1

H₀: There is no significant difference in the frequencies of the error types committed by both the science and the non-science Biology students.

Table 2: Summary of the t-test Analysis of the Comparison of the Mean of the Frequencies of the Error types Committed by Science and Non-science Subjects.

S/N	Error types	Variable	N	Mean	S.D	Df	t-cal	t-critic	p-value	Mean
1.	Random errors (Error Type I)	Science	342	6.00	2.31	682	-0.583	1.97	0.565	NS
		Non science	342	6.56	2.24					
2.	Errors related to sequence of steps within procedures (Error Type II)	Science	342	4.19	1.94	682	4.740	1.97	0.000	S*
		Non Science	342	7.78	1.56					
3.	Error related to conceptual learning (Error Type III)	Science	342	1.56	1.21	682	2.75	1.97	0.011	S*
		Non Science	342	2.89	1.05					
4.	Errors related to selection of information or procedure (Error Type IV)	Science	342	2.86	1.41	682	0.163	1.97	0.872	NS
		Non Science	342	2.78	1.49					
5.	Errors related to recording of work. (Error Type V)	Science	342	10.00	2.59	682	2.746	1.97	0.012	S*
		Non Science	342	12.78	2.11					

*at $P \leq 0.05$

Table 2: shows that there are significant differences in the t-test analysis of the mean score of frequencies of error types by science and non-science subjects only in errors types II, III and V at $p \leq 0.05$. Hence the hypothesis No. 1 is

rejected for each of these (II, III and V) and not rejected for error types I and IV.

Null hypothesis II

Ho2: There is no significant difference in the mean academic achievement in BTISET between

science and non-science Biology students.

Table 3: Summary of the t-test Analysis of the Comparison of the Mean Scores of Achievements in BTISET between Science and Non-science Students

Variable	N	Mean	S.D	S.E	Df	t-cal	t-critic	P-value	Rem
Science	342	27.67	7.74	0.49	682	4.453	1.96	0.000	S*
Non science	342	25.68	7.25	0.46					

*at $P < 0.05$

The results in **Table 3:** shows that the value of t-cal 4.453 is greater than the value of t-crit 1.96 at $p=0.000$ with $df = 682$, the mean scores of academic achievement is higher in the science students than the non-science students and thus significant. Hence, the Null hypothesis is rejected.

DISCUSSIONS

From the analysis of results in **Table 2,** it was observed that the null hypothesis I which stated that there is no significant differences between the frequencies of the occurrence of the error types committed by both the science and the non-science subjects was rejected in error types; (Errors related to sequence of steps within procedures i.e. error II), (Errors related to conceptual learning i.e. error III), and (Errors related to recording of work i.e. error V) because it was significant in each case. However, for other error types; (Random errors i.e. error I), (Errors related to selection of information or procedure i.e. error IV), it was not significant in each of the cases, as such the null hypothesis was accepted for each of these.

The significant difference observed in the error types, II, III and V between the science and the non-science subjects could be explained in terms of their means and the standard deviations.

In each of these error types, the mean as well as the standard deviation (S.D.) of the non-science subjects is higher than that of the science students. This means that the science students did well than the non-science students in the frequencies of the error types with reference to where there are significant differences between the science and the non-science students. This means that the non-science students did not do well when compared to the science students. This could be explained in terms of the fact that most science students placed in this class had a good result in their JSSCE integrated science. This view is supported by Hamman-Tukur & Sofeme (2002) where they stated that academic achievement in the JSSCE Integrated science has a predictive validity in Biology, Chemistry and Physics in the SSCE. Similarly, the finding is in line with Mukherjee (2002), where he stated that performance of one task influences performance of some subsequent tasks in learning. The transfer effects of learning proceed from concepts to rules and to that of problem solving. This could be positive, negative or neutral effects.

From the analysis of **Table 3,** it was observed that the Null hypothesis II which stated that; there is no significant difference in the mean academic achievement in BTISET between science and non-

science Biology students is rejected. This is because the t-calculated is greater in value than the t-crit at $p = 0.000$. This could have been arisen due to the background knowledge of Integrated science of the science students at JSSCE being stronger than that of the non-science students and hence improve their academic achievement in BTISET.

CONCLUSION

Based on the findings of this study, it can be concluded that the errors committed by non-science students were errors related to sequence of steps within the procedures (Error Type II), errors related to conceptual learning (Error Type III) and errors related to recording of work (Error Type V).

REFERENCES

- Akpna, E.U.U (1989): Nigerian Students' Poor Examinations: Implications for Teachers Education *Journal of the Science teachers' Association of Nigeria*, 24 (1).
- Ben-Yunusa, M. (2000): *Issues on curriculum*. Sankore Education Publishers Company Ltd. Zaria Kaduna State.
- Federal Ministry of Education (2004): *National Policy on Education*. National Education Research and Development Council Federal Government Press Lagos.
- Hamman-Tukur, A and Sofeme, J.R. (2002): Predictive validity of Integrated Science Junior Secondary School Certificate Examination in Federal Government Colleges. *Zaria Journal of Studies in Education* 3 (1), 18-25.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. Biology Teachers should pay special attention to non-science students to correct these errors in their Studies. This will help to improve the academic performance of the students in Senior Secondary School Certificate Examination.
2. Biology Teachers should be encouraged to attend seminars and conferences to update their knowledge for effective learning.

Mukherjee A. (2002): *Educational Psychology for Teachers' Students and parents*. S. Asekome and Co. Publishers, Samaru, Zaria, Nigeria.

Mustapha, M. T. (2005): Evaluation of what National Examinations Council (NECO) Senior School Certificate Biology Examination Tests. *Minna journal of Science Education and Allied Research*, 1 (1) 26 – 33.

Olatoye, R.A. and Afuwape, M.O (2004): Emergent Issues in enhancing the teaching and learning of science in schools. In Afemikhe, O.A. and Adewale, J.G. (Eds). *Issues in Educational Measurement and Evaluation in Nigeria*, Institute of Education, University of Ibadan.

Okebukola, P.A.O. (2008): Positioning Nigeria's Educational system for the Achievement of the National 20 – 2020 vision; Educational Reform Imperatives for achieving vision

20 - 2020. One of the lead papers presented at the National Educational summit organized by the Senate Committee on Education, held between 10th and 11th of December, 2008, Abia.

Soyibo, K. (1982): Attitudes of Nigerian students towards physics. *Journal of Science Teachers Association of Nigeria*, 20 (2) 158 - 168.

Suydams M.N (1985): Developing Computational Scheme NCTM (1978) year Book, Ohio State University.

Wasagu, M. A. (2000): Introduction to curriculum studies. In M. I. Junaid, A.A. Salami and M.G. mai Tafsir (Ed) *Reading in Education*. Vol. 1 Sokoto Educational Foundation unit.

West African Examination Council (2007-2012) Chief Examiner Report on Senior Secondary School Certificate Examination.