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Evaluating Effect of Students' Academic Achievement on Identified Difficult Concepts in Senior Secondary School Biology in Delta State

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ABSTRACT

This study evaluated the effect of students' academic achievement on identified difficult concepts or topics in Senior Secondary School Biology in Delta State, Nigeria. The study was quasi-experimental and the design was a 2X2 factorial non-randomized pretest-posttest control group design. The sample was drawn from intact classes from four coeducational schools located in urban and rural centres in Delta Central Senatorial District. A total of 160 male and female students were used in the study. The sample were got using purposive sampling technique. The instrument for the study was designed by the researchers and tagged Biology Achievement Test (BAT). This was validated by experts and Kuder- Richardson formula 21 was used for the reliability estimate and this yielded 0.71 alpha. This was tested at 0.05 significant level. The methods used for evaluating the students was Concept-mapping and the Regular Teaching Methods, as experimental and control groups respectively. The results showed that students perceived some topics like Hereditary, Genetics, Ecology as difficult while it was found out that gender (male and female sex) and school location (urban and rural) had no effect on difficult concepts in Biology. Based on these, recommendations were made; such as innovative teaching strategies like concept mapping be used in our classrooms.
Keyword: Evaluating Effect, Students Academic Achievement, Identified Difficult Concepts, Male and Female Sex, School Location (urban and rural) and Intact Class

Introduction

Science in the secondary schools is taught through two main categories; as Basic Science at the Basic secondary and the separate science subjects as Chemistry, Physics and Biology at the Senior Secondary. It is however worrisome to note that research studies and findings had pointed out that there is low achievement in secondary school science (Onwuakpa and Nweke, 2000).

Biology as the science of life is offered in all Senior Secondary Schools in Nigeria which attracts the greatest patronage of both Science oriented and Arts based students (Nwosu, 2006). Urevbu (1990) pointed out that the teaching of Biology is important because it equips the students to comprehend the world around them and equip them with the necessary skills to build a progressive society. Similarly, Nwosu (2005) observed that Biology provides a platform for teaching students to develop the ability to apply science concepts and principles in solving everyday life problems. With knowledge explosion all over the world via the Internet, biological knowledge has also expanded. There are advances recorded in fields such as Biochemistry, Physiology, Ecology, Genetics and Molecular biology that have made the subject a central focus in most human activities including problems like food scarcity, pollution, population, radiation, disease, health, hygiene, family life, management and conservation of natural resources as well as Biotechnology and Ethics.

However, over the years, performance of students has not been very impressive from the West African Examination Council (WAEC) and National Examination Council (NECO) in the science especially in Biology. Below is a highlight of performance in Biology in NECO examination between 2001 and 2006.

Performance of Candidates in SSCE Science, including Biology

Year	Subjects	No. of candidates	No. that passed	% that passed	No. that failed	% that failed
2001	Biology	906,534	359,983	39.71	503,682	55.56
	Physics	249,309	143,282	57.47	95,169	38.17
	Chemistry	263,172	142,799	54.26	108,503	41.23
	Mathematics	915,142	367,927	40.20	509,932	55.72
2002	Biology	1,027,351	623,572	60.7	364,340	33.71
	Physics	289,381	151,532	52.36	123,187	42.57
	Chemistry	303,409	162,401	53.53	125,107	41.23
	Mathematics	1,034,644	495,103	47.85	467,481	45.18
2003	Biology	890.487	459,122	51.56	377,955	42.44
	Physics	260,995	134.234	51.43	112,900	43.26
	Chemistry	269,339	138,912	51.58	115,562	42.91
	Mathematics	902,344	372,672	41.30	468,768	51.95
2004	Biology	897,707	295,777	32.95	515,118	57.38
	Physics	280,141	102,475	36.58	157,849	56.35
	Chemistry	286,955	158,995	55.41	106,418	37.09
	Mathematics	888,542	496,926	55.93	327,560	36.89
2005	Biology	868,186	228,370	26.30	552,577	63.65
	Physics	277,339	135, 314	48.79	117,212	42.26
	Chemistry	281,580	77,819	27.64	177,599	63.07
	Mathematics	867,578	228,710	26.09	543,538	62.01
2006	Biology	917,689	440,190	47.97	390,548	42.56
	Physics	297,206	141,325	47.55	131,862	44.37
	Chemistry	301,039	129,676	43.03	144,934	48.14
	Mathematics	924,855	434,807	47.02	388,158	41.97

Source: National Examination Council, 2001-2006 Annual Report

From the above results, performance in the sciences including Biology have not been encouraging. This can be traced to as far back as 1986 where the then Minister of Education, Professor Jubril Aminu expressed his utmost disappointment over students' poor performances in WAEC examination. The situation has not changed appreciably as Olotu (1992) also expressed the same view but attributed these failures to ineffective or inappropriate teaching methods.

In the same vein, Okafor and Okeke (2006) noted that students' lack of understanding of difficult concepts in Biology results in poor performance of students at SSCE and backwardness in scientific and technological advancement of our nation. Umeh (2002) revealed that the nonchalant attitude of students and teachers in the Senior Secondary Schools towards certain concepts in the Biology curriculum are also responsible for poor performance.

In spite of effort through research on strategies to improve performance in Biology, researcher reports and the WAEC chief examiners annual reports have continued to highlight students' weakness in answering questions relating to difficult concepts in the areas such as of Genetics, Ecology and Evolution. Such weaknesses continue to induce students' inability to comprehend or represent concepts in tables, graph and diagrams.

These repeated reports of constant poor performance in SSCE Biology have attracted a lot of concern from science educators. Thus, research in science education in Nigeria has continued to seek better ways of teaching Biology in order to maximize meaningful learningSSS and to identify causal variables for the repeated failures in examinations at the SSCE (Esiobu, 2000, Ajaja and Kpangban, 2000). In order to avert this, concept-mapping as a tearching strategy has been well emphasized as a method that can enhance performance in Biology and other related subjects.

Concept-mapping as a teaching strategy promotes meaningful learning in the teaching-learning situation. For example, studies carried out by Jegede, Alaiyemola and Okebukola (1990) showed that students taught with concept-mapping scored significantly higher than students taught using the Lecture/Regular teaching method. According to them, concept-mapping reduces anxiety, thereby enhancing achievement in Biology. In the same vein, Peter(1999) investigated the relative effectiveness of concept-mapping and lecture method in Chemistry. The study revealed that concept-mapping when compared with lecture method produced a significant gain in cognitive achievement than that of the lecture method. Also Asiya (2005) observed that Chemistry students taught with concept-mapping recalled what was taught and can apply them at any time when compared to those taught with the conventional method.

In another development, Njoku (2006), Ugwu (2007) and Nwagbo and Obiekwe (2010) identified several factors that contributes to the level of difficulty in the teaching and learning of science. These according to them include teaching methodology, lack of qualified teachers, school setting (location), students' ability and teachers' effectiveness. Okebukola (2002) referred to these factors as barriers. Evidence from research work in Nigeria indicates that very little research efforts had been directed on difficulty of concepts in Biology. It was purely in an attempt to bridge the gap that this study was carried out. The purpose of this study therefore, was to specifically evaluate effect of students' academic achievement on identified difficult concepts in Senior Secondary School Biology in Delta State using concept-mapping as a teaching strategy

Statement of the Problem

Education is an indispensable instrument for the development of any nation. Teachers are the implementers of the educational programme and they are responsible for the translation of educational theories into practice. For teaching to be effective, it has to be rooted in an understanding of how students learn. Several researchers have conducted research with a view to finding better ways of teaching and learning Biology. Results indicated that performance in public examination in Biology still remain poor. Not much effort seems to have been made towards finding out the difficulties students encounter in learning some of the concepts in Biology. Although, many factors may account for students' poor performance in Biology, it is evident that most students have difficulties in learning some concepts.

It is for this purpose of redressing this trend that this study is being carried out. The statement of the problem therefore is: Will students' performance of identified difficult concepts generate interesting results for solving the problem of persistent poor performance in Biology at the Senior School Certificate Examination?

Research Questions

The following research questions were formulated to guide this study.

1. What content areas of the Senior Secondary School Biology are difficult for the students to comprehend?

2. Why do Biology students perceive some of the identified concepts difficult?

3. Will there be any difference in students' test score between difficult and simple topics in Biology?

4. Will there be any difference in test score between male and female students on identified difficult topics in Biology?

5. Will school location influence students' achievement on identified difficult topic in Biology?

Research Hypotheses

The following hypotheses were formulated for testing at 0.05 level of significance

1. There will be no significant difference in students test score between difficult and simple topics in Biology.

2. There will be no significant difference in test score between male and female students on identified difficult topics in Biology.

3. There will be no significant difference between school location and students' achievement in identified difficult topics in Biology.

Purpose of the Study

The purpose of the study is to evaluate effect of students' performance on identified difficult topics in Senior Secondary School Biology. The study was specifically an attempt to:

1. Compare students test score in the difficult topic areas and the equivalent simple topic areas in Biology.

2. Find out the extent to which sex influences students' performance on identified difficult topics in Biology.

3. Identify the difficult areas in Senior Secondary School Biology

4. Advance reasons why these areas are termed difficult for students to understand.

5. Find out the extent to which school location influences students' performance on identified difficult topics.

Methodology

A non-randomized pretest-posttest control group design was used in this study. This is a quasi-experimental design. Intact classes were used in the study. The design of the study was a 2X2 factorial design. The population consisted all Senior Secondary School III Biology students drawn from the state owned Senior Secondary Schools in the Delta Central Senatorial District.

The sample consisted one hundred and sixty (160) SS III Biology students comprising eighty (80) females and eighty (80) male students. The schools sampled were government owned public schools. The purposive sampling technique was employed. Four mixed school (two rural and two urban) were randomly selected from the Senatorial District. In each school, one intact class was used in the study. The schools were also randomly assigned either as experimental or control groups. The Biology teachers in each school were used by the researchers as research instructors.

The research instrument used for this study was the teacher made test, which was tagged Biology Achievement Test (BAT) questionnaire. The students' questionnaire was constructed by the researchers from past Senior School Certificate Examination question papers and from students' interview on the concepts they considered difficult. BAT consists of a 50 multiple choice test items developed by the researchers on the identified difficult topics as well as simple topics in SSCE Biology.

The research instruments were subjected to both content and face validity by experts in Science Education and Measurement and Evaluation. Ruder-Richardson formula 21 was used to test the internal consistency of the test items and reliability estimate of 0.71 was established. This was adjudged high enough for the study.

The Regular Biology Teachers in the selected schools were used for the study after being trained for a period of two weeks on how to use the instrument in the study. At the end of the training, the instructors for the experimental groups were given a copy of the instructional packages comprising a six (6) week instructional units and a comprehensive lesson plan for the study. The test instrument (BAT) was administered in all the groups as a pretest for the study before treatment.

The main treatment for the study was teaching the identified difficult topics in Biology using the Concept-mapping strategy(CMS) for the experimental group and the Regular Teaching Method (RTM) as the control. The control group was subjected to questioning method.

After the completion of the teaching, BAT was again administered (after reshuffling) the items as post-test and the scores subjected to analysis using descriptive statistics to answer the research questions. The scores obtain from the pre-test and post-test were analyzed using mean and standard deviation to answer the research questions while t-test(Inferential statistics) was used in testing the stated hypotheses.

Results and Discussion

Results

Table 1: Mean distribution of difficulty level on Biology students' perception on topic they find difficult to learn

s/n	Topics	X	Difficulty level
1	Living things	2.51	ND
2	Cell and Animal Nutrition	2.40	ND
3	Cell and Its Environment	2.60	ND
4	Excretory System	2.30	D
5	Respiratory System	2.52	ND
6	Digestive System	2.80	ND
7	Transport System	2.50	ND
8	Nervous System	2.30	D
9	Ecology	1.60	VD
10	Evolution	1.60	VD
11	Genetics	1.62	VD
12	Energy transformation in nature	2.0	D
13	Hormonal coordination	2.0	D
14	Conservation of natural resources	2.0	D
15	Variation in population	2.0	D
16	Reproductive system	2.76	ND
17	Food production	2.80	ND
18	Population	1.90	D
19	Sense Organ	2.50	ND
20	Terrestrial hoisted	2.0	D
21	Circulatory system	2.0	D
22	Adaptation for survival	2.40	ND

From the above Table, students perceived 12 topics difficult to learn, out of which 3 topics are very difficult, 10 not difficult while 9 topics as difficult.

Table 2: Distribution of reason why students perceive some Biology topic as difficult to learn

s/n	Reasons for difficulty	X	Difficulty level
1	Most topics are not well taught by the teacher	2.6	A
2	Most difficult topics are not taught practically	2.4	DA
3	Topics are not explained with local example	2.4	DA
4	Time allocation to the subject is too small	2.5	A
5	No Biology laboratory for practical	2.6	A
6	Poor study habits among students	2.6	A
7	Syllabus is vast	2.5	A
8	Insufficient textbooks for private studies	2.3	DA
9	Some topics are for abstract and requires much thinking	2.5	A
10	Some teachers show no interest in some topic and in the subject in general	2.3	DA
11	Teaching methods used by teachers make the topics difficult to learn	2.4	DA
12	Lecture method dominates the entire lesson	2.4	DA
13	Students have no interest in the subject	2.4	DA
14	Inability of the teacher to convincingly put across the Biology concept to the students	2.4	DA
15	School location influences the level of difficulty	2.5	DA
16	Non-professional Biology teacher teaching the subject	2.6	A

From the table above, seven items out of sixteen disagree while five items agree on students perceived difficult topics in Biology. The mean rating is 2.5 and above agree while below 2.5 disagree

Table 3: Mean and Standard Deviation of achievement between male and female students taught difficult topic in Biology

Sex	X	N	SD
Male	23.11	80	5.21
Female	23.02	80	8.44

From above, female mean score is 23.02 while male is 23.11 and standard deviation is 8.44 and 5.21 respectively.

Table 4: Mean and Standard Deviation of achievement of difficult and simple topics in Biology

Group	X	N	SD
Difficult	12.35	80	7.32
Simple	15.75	80	7.14

From above, difficult mean score is 12.35 while simple mean score is 15.75. Standard deviation for difficult group is 7.32 while simple group is 7.14

Table 5: Mean and Standard Deviation of achievement between urban and rural students on difficult topic in Biology

Location	X	N	SD
Rural	11.55	80	5.97
Urban	11.80	80	5.20

From above, rural centre mean score is 11.55 while urban mean score is 11.80. Standard deviation for rural is 5.97 while urban is 5.20

Table 6: t-test comparison of students achievement in difficult and simple topics in Biology

Groups	N	X	SD	Df	t-cal	t-crit	Decision
Difficult	80	12.35	7.32	158	3.82	1.96	Significant
Simple	80	15.78	7.14				

P< .05

From above, the calculated t is 3.82 while the t-critical is 1.96. Since the calculated t is greater than the t-critical, the null hypothesis 1 is rejected meaning that there is a significant difference between students test score in difficult and simple topics in Biology.

Table 7: t-test comparison of male and female students' achievement in difficult topics in Biology

Groups	N	X	SD	Df	t-cal	t-crit	Decision
Male	80	23.11	8.21	158	1.72	1.96	Not Significant
Female	80	23.02	8.44				

P< .05

From the table above, the t-calculated is less than the t-critical. Hence, there is no significant difference between male and female students on identified difficult topics in Biology. Hypothesis 2 is therefore accepted or retained.

Table 8: t-test comparison or urban and rural students' achievement in difficult topics in Biology

Groups	N	X	SD	Df	t-cal	t-crit	Decision
Rural	80	11.55	5.97	158	1.04	1.96	Not Significant
Urban	80	11.86	5.20				

P< .05

From the table above, the t-calculated is less than the t-critical. Hence, there is no significant difference between rural and urban students on identified difficult topics in Biology. Hypothesis 3 is accepted or retained.

Discussion

The result from table 1 clearly showed that students had difficulty in learning some concepts in Biology. This findings is in agreement with the findings of Anyanwu (1991), Umeh (2002) and Makanjuola (2002) who noted that a number of topics in Biology namely Genetics, Evolution, Ecology among others pose

unique and formidable challenges to the students. This was buttressed by the WAEC Chief Examiner yearly report of 1991, 2000 and 2004 indicating that Biology candidates lack the knowledge of Basic Concepts in Biology and exhibits weakness in answering questions relating to Concepts such as Genetics.

The results in table 4 and 6 indicates that there was a significant difference in the achievement of students in the perceived difficult and simple topics in Biology. Students exposed to the simple topics performed better in the achievement test than those exposed to the perceived difficult topics. This portrays that students have difficulties in learning some concepts in Biology as highlighted by Okafor and Okeke (2006). According to Abdullahi (1982) and Ajaja (2007), the reason why students may find some topics difficult could be due to the persistent use of lecture method for teaching Biology as against the recommended discovery/inquiry approaches which are student-activity centred. Adeyemi (2008) noted that when students are always exposed to practical lesson with good quality teachers and quality teaching methods, they will obviously find most of these concepts in Biology less difficult.

From the results in table 3 and 7, there was no significant difference between the performance of male and female students when exposed to difficult topics in Biology. The result indicates that sex (male and female) does not influence students' difficulty level in Biology. The findings of this study is in agreement with those of Akpokorie (2000) and Omajuwa (2011) who found that sex have no influence on students experienced difficulty in Biology. But this however, contradicts the opinion of Njoku (2000) who asserted that girls perform poorly in relation to boys in science subjects.

Result also showed that school location (urban or rural) does not influence students' difficulty level in Biology. It was observed in table 5 and 8 that there was no significant difference in academic achievement between urban and rural students in terms of difficulty in Biological concepts. However, the study is consistent with the finding of Omajuwa (2011) who found that school location has no influence on students' experienced difficulty in Biology. Students from rural areas no longer have lower self-esteem but are as ambitious as their urban counterparts.

Conclusion

From the findings of this study, the efficacy of concept –mapping has been well emphasized. The use of concept-mapping instructional strategy was more effective and superior to the Regular teaching method (Conventional teaching method) in improving students' achievement in Biology. That is, based on the fact that, the strategy will make Biology teachers to adequately plain, prepare for lessons and present lessons that will enhance learning. Use of concept-mapping as in this study has clearly shown that its use in normal classroom situation will enhance learning, since students taught with it obtained higher scores and retained more content materials than those taught with the regular teaching method. It has also been concluded that sex and school location has no effect on students' achievement in Biology. That goes to say that both male and female students' show equal level of difficulty in learning some biological concepts, whether students' are in urban or rural centres.

Recommendations

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

1. Biology teachers should adopt the innovative teaching strategies such as concept mapping in teaching some of the difficult topics in Biology.

2. Biology teachers should present the difficult concepts in clearer terms starting from simple to complex.

3. Policy makers should promote programmes and provide facilities that could be used in teaching Biology that would help remove the dreaded difficult areas in Biology. This no doubt would help stimulate students' interest in Biology.

4. Teachers in rural and urban centres be given incentives to improve their lots in the work place for them to put in their best. This is because teachers' effectiveness plays a major role in students' academic achievement.

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REFERENCES

Abdullahi, A. (1982). Age environmental factors in attitude of Nigerian high school students towards science. *Benin Journal of Educational Studies*, 1(1): 90-94.

Adeyemi, T. O. (2008). The influence of class size on the quality of output in secondary schools in Ekiti State, Nigeria. *American-Eurasian Journal of Scientific Research,* 3(1): 7-14.

Ajaja, O. P. (2007). *Teaching method across discipline*. Ibadan: Boman Prints.

Ajaja, O. P. & Kpabgban, E. (2000). Enriching biology teaching in the 21st century in Nigeria. Implication for the teacher. *41st Annual Conference Proceedings of STAN,* 138-140.

Anyanwu, F. O. (1991). An investigation of students learning difficulties in biology. A case study of Gongola State. *Doagiret Journal of Education*, 1: 18-25.

Akpokorie, B. T. (2000). Junior secondary school integrated science: student's difficulties in process skills acquisition in Warri and its environs. Unpublished M.Ed. Dissertation, Delta State University, Abraka.

Asiya, R. I. (2005). Enhancing chemistry teaching in secondary school through concept mapping instructional strategy. *46th Annual Conference Proceedings of STAN:* 205-209.

Esiobu, G. O. (2000). Biology teacher's awareness and level of use of mental analysis in teaching difficult concepts in biology. *41st STAN Proceedings,* 116.

Jegede, O. J, Alaiyemola, F. T. and Okebukola, P. A. (1990). The effects of concept-mapping in students' anxiety and achievement in Biology. *Journal of Research in Science Teaching* 27(10). 951-960.

Makanjuola, A. R. O. (2002). Identification of difficult topics in the senior secondary school certificate biology syllabus as perceived by students. *Journal of Education published by the National Commission for Colleges of Education, Abuja,* 109-115.

Njoku, Z. C. (2006). Gender and acquisition of science process skills among secondary school students. Implication for science and teaching. *42nd Annual Conference proceedings of STAN*, 200-209.

Nwagbo, C. and Obiekwe, C. (2010). Effects of constructivist instructional approach in student's achievement in basic ecological concepts in biology. *Journal of STAN,* 26-35.

Nwosu, A. A. (2005). Teacher characteristics preferred by students': Implication for professional development practices. *Proceeding of 46th Annual Conference of STAN*, 35-39.

Nwosu, A. A. (2006). Biology education for the new millennium. In E. A. C. Okeke (Ed) *Educational reform in Nigeria for the new millennium.*

Okebukola, P. A. O. (2002) Beyond the stereotype to new trajectonein science teaching special. *Lecture Presented at 43rd Annual Conference of STAN,* 19-23.

Okafor, E. N. and Okeke, S. O. C. (2006). Concepts mapping as an effective technique for teaching difficult concepts in biology. *47th Annual s Conference Proceedings of STAN,* 122-127

Olotu, B. (1992). The main causes of student under-achievement in agricultural science. *Journal of STAN* 27(2).

Omajuwa, J. (2011). Senior secondary school student's difficulties in chemistry process skill acquisition. *Unpublished M.Ed. Dissertation, Delta State University, Abraka.*

Onwuakpa, F. I. and Nweke, A. O. (2000). Enriching science technology and mathematics education in secondary schools through effective utilization of resources in the classroom. *41st Annual Conference Proceedings of STAN,* 34-37.

Oyovwi, E. O. (2007). Effects of discovery and inquiry approaches on performance of students in biology in secondary school. *Unpublished M.Ed. Dissertation, Delta State University, Abraka.*

Oyovwi, E. O. (2012). Science curriculum innovation in Nigeria senior secondary school: Challenges and prospects. *Academic Forum,* 74-79.

Peter, E. O. (1999). The relative effectiveness of concept-mapping instructional method and lecture method in the teaching of chemistry to senior secondary school students. *Unpublished Ph.D. Thesis. University of Benin, Benin-City.*

Ugwu, A. (2007). Towards inculcation of chemistry practical skills in students-teacher difficulties. *Journal of STAN,* 106-109

Umeh, M. O. (2002). Reducing teacher instructional difficulties in some context areas of senior secondary school biology curriculum for sustainable development. *Proceedings of the 43rd Annual Conference and Inaugural Conference of CSTME Africa,* 219-223.

Urevbu, A. O. (1990). *Methodology of science teaching.* Benin-city: Juland Educational Publishers.

WAEC (1999). Chief Examiners' report, Nov/Dec. 1999 G.C.E (O/L) Lagos, Nigeria.

WAEC (2000). Chief Examiners' report, May/June. 2000 G.C.E (O/L) Lagos, Nigeria.