

EFFECTS OF TEAM-BASED LEARNING ON SECONDARY SCHOOL STUDENTS' ACADEMIC PERFORMANCE AND RETENTION IN THE TEACHING OF NERVOUS SYSTEM (BIOLOGY) IN NIGER STATE, NIGERIA

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Abstract

This Study investigated the effects of Team-Based Learning on Secondary School Students' academic performance and retention in teaching of Nervous System (Biology) in Niger state, Nigeria. It adopted a combined Pretest Posttest, Non-equivalent groups' Quasi-Experimental design. From the population of twenty-two thousand, eight hundred and eleven (22,811) Public Secondary School (SS) II students, one hundred and fifty-five (155) participants were sampled through stratified random sampling techniques. The study had a test and a treatment instrument. Those instruments were validated by experts in science education. During pilot-testing, the validated test instrument was tested and retested using the same population and environmental conditions but outside the targeted samples and 0.77 reliability coefficient was obtained through Crombach alpha and was then administered as pretest, posttest and post posttest to the three groups by the help of Research Assistants. The data collected were analyzed by mean and standard deviation to answer the research questions while t-test was used test the null hypotheses at $\alpha = 0.05$. The major finding was that, Students taught Nervous System using Team-Based learning performed and retained significantly better than those taught using Lecture Method. Based on the aforementioned, this study concluded that the use of Team-Based learning was more effective in teaching Nervous system in Biology than lectures method among Secondary School Students in Niger State. The study therefore, recommended that Team-Based learning be encouraged among Biology Teachers in teaching Nervous system and other Biology concepts in Niger State and Nigerian Secondary Schools.

KEY WORDS: Team-Based Learning, academic performance, retention, Nervous system and Lecture Method

1. Introduction

Education is an effort to develop the ability of individuals to live optimally as individuals or members of the society. On that note, the industrialized nations of the world have used Science Education as a tool for their development. And it is contributing immensely to their quality of life

and actualizing United Nation's Sustainable Development Goals such as in health sufficiency, food security, transportation satisfaction, energy production and industrial development for poverty reduction (Chris, 2015). In Nigeria, biology is one of the science subjects at Senior secondary school level. Nervous System is a major theme of Secondary Schools Biology curriculum. Goldman (2017) defined Nervous System as a complex network of nerve cells that carry messages to and fro the Central Nervous System to various parts of the body of an animal. Man's mental life and Learning depends on the health of his Nervous System (Kawal 2017). Hence, Biology has important roles to play in the society in terms of healthy living, body hygiene, environmental sanitation and global Ecological management. Biology is also a prerequisite to admission into health institutions and health related courses in Nigeria and abroad. Thus, Biology needs to be taught effectively.

However, teaching of biology in Nigerian Senior Secondary Schools is still by traditional teaching methods such as lecture method, which are ineffective in improving academic achievement in Biology as lamented upon by Amakiri & Ukwuije, (2016). Alternatively, Ching-hsiang et al (2014) have recommended Team-Based Learning as one of the effective teaching methods in this fast-changing and scientific-driven era. Team-Based Learning is one of the Collaborative Learning methods which Laal (2012) termed as an umbrella phrase for a variety of teaching approaches involving students or students and teachers working together in groups of twos or more in the classrooms or laboratories. All Collaborative Learning methods reduce the role of a teacher from a dictator to a facilitator in the classroom. They were developed based on Vygotsky's Socio-Constructivist Theory of Learning in the 1920s and early '30s (Tinzmann, etal 1990).

Collaborative Learning has the following types namely according University of Maryland (2018): Team-Based learning, Cooperative learning, Think-Pair-Share, Problem-Based learning Peer tutoring, Jigsaw strategy etc. But this study is delimited to Team-Based Learning. Team-Based Learning entails that all learners or Collaborators are being giving academic tasks in advance. Then, the Teacher subsequently evaluates individual student before at the group level to ascertain their existing knowledge and based on recorded scores, the Teacher delivers a correctional lecture to clear all identified misconceptions (Barton et-al 2017).

Furthermore, some empirical related studies on Collaborative Learning methods in science subjects were reviewed. Some of which were Kolawole (2008) in his study investigated the effects of the Cooperative and Competitive Learning on academic performance of students in mathematics and he found that Cooperative Learning strategy is more effective than Competitive Learning Strategy. Hossain and Tarmizi (2013) on the other hand, studied the effects of Team-Based Learning on Students' achievement in mathematics in selected secondary schools and he found that students in Team-Based Learning group in mathematics had been affected positively. In addition, Muraya and Kimamo (2011) studied the effects of Team-Based Learning approach on Biology mean achievement scores of Secondary School students and was found that Cooperative learning approached students have significantly higher achievement scores compared to regular

lecture method. Nneka (2015) examined the effect of Team-Based Learning instructional strategy on Senior Secondary School Students' achievement in Biology. The results revealed that students taught using Team-Based Learning instructional strategy performed better in Biology retention than those taught using lecture method of instruction. Chatila and Husseiny (2017) on its part studied the effect of Team-Based Learning Strategy on Students' Acquisition and Practice of Scientific Skills in Biology also found that Team-Based Learning has a significant effect on students' retention in learning scientific skills in grade ten.

2. Statement of the Problem

Despite the studies by the Biology Educators such as Yunusa, Abdulwahid and Mustapha, (2014) on the improvement of academic performance and retention in Biology because of its importance to the National growth and development and as a prerequisite to admission into health related courses in Tertiary Health Institutions in Nigeria and Abroad, there are still reports of existing Students' poor academic achievements in Biology among Secondary School graduates as presented in table 1;

Table 1: Niger State WAEC SSCE Biology Results 2010-2020

Year	Number of Candidates Registered	Number of credits	(A,B, C) %	Number of passes	(D,E) %	Number of fails	(F), %	Passes + fails	(D,E +F) %
2010	10296	2178	21.15	3483	33.83	4635	45.02	8,118	78.85
2011	24938	3469	13.91	6528	26.18	14941	59.91	21,469	86.09
2012	27805	1897	6.82	7514	27.02	18394	66.19	25,908	93.18
2013	13712	1544	11.26	3705	27.02	8463	61.72	12,168	88.74
2014	11201	3108	27.75	2803	25.02	5290	47.23	8,093	72.25
2015	3676	1032	28.05	1080	29.36	1567	42.59	2,647	72.01
2016	4093	1078	26.34	1692	41.34	1323	32.32	3,015	73.66
2017	2335	883	37.82	647	27.70	805	34.48	1,452	62.18
2018	1987	958	48.2	532	26.77	497	25.01	1,029	51.79
2019	1758	762	43.34	683	38.85	313	17.81	871	56.66
2020	2083	1032	49.54	511	24.53	540	25.92	1,051	50.46
Total	103,884	18,066	17.39	29,137	28.05	56,684	54.56	82,870	79.77

Source: Niger State Ministry of Education (MOE), Schools Service Exams Unit, Minna, 2021.

Table 1 reported West African Examinations Council (WAEC) Senior School Certificate Examinations (SSCE) Biology results from 2010 to 2020 and indicated that the number of students with high academic achievement (number of credits with grades As, Bs, and Cs) which are admissible into tertiary institutions persistently ranged from 11.26% to 49.54% while the number of students with low academic achievement (number of passes with grades Ds and Es) plus the number of students with poor academic achievement (number of fails with grade Fs) which are inadmissible into universities ranged from 50.46% to 93.18%. It is in response to the identified

problem that this present study is designed using the Jabareen's (2009) system approach-conceptual framework and Vygotsky's Socio-Constructivist Theory of Learning to examine the efficacy of the effects of Team-Based Learning on senior Secondary School Students' academic performance and retention in the study Nervous System in Niger state, Nigeria under the following objectives.

2.1 Research objectives

The objectives of this study were to determined

1. Whether there is difference in performance between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method.
2. Whether there is difference in retention between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method.

2.2 Research Questions

The two research questions raised to guide this study were as follows

1. What is the difference in performance between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?
2. What is the difference in retention between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?

2.3 Null Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in performance between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?
2. There is no significant difference in retention between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?

3. Methodology

This study used a combined pretest posttest Non-Equivalent groups Quasi-Experimental Design, because it manipulated the independent variable on the dependent variable without restriction and randomization of samples. The population consisted of twenty-two thousand, eight hundred and eleven (22811) males and females Public Senior Secondary School II (SSII) Students between 17- and 19-years of 2018/2019 academic session from the seven (7) Educational Zones of Niger State. The sample size was of one hundred and fifty-five (155) participants were sampled through stratified, random sampling techniques. In doing that, the Researcher used the existing partitioning of Niger State's seven (7) Educational Zones as strata and randomly selected two (2) Educational

Zones from where one School from each was also randomly chosen to take part as Experimental and Control Groups. And at the schools' level, intact-classes were used as presented in table 2.

Table 2: Summary of Population and Sample of the Study

Educational Zones	Population	Sampled Schools	M	F	Total per School
(1) Minna Zone	18016	GDSS Limawa Minna	49	32	81
(2) Kontagora Zone	4795	DSS Mariga	50	24	74
Grand Total	2811	2	136	82	155

Source: MOE, Department of Planning, Research and Statistics (PRS) (2019).

Since the study could not use random sampling technique, in order to control the extraneous variables effects which could jeopardize the internal validity of the study, the study took the following measures; pretested all groups for equivalence level before treatment, randomization of participating schools to avoid selection bias, moderating experimentation duration to avoid the effect of maturation, use of different schools for experimental and control groups to avoid Researcher's experimental bias.

Furthermore, two Research instruments were used in the study viz; the adapted Treatment instrument named Team-Based Learning Tool (TBLT) in form of Lesson Plans I to XIII with their corresponding Mammalian Nervous System Topics and Sub-Topics was developed for experimental group's treatment, while ordinary or plane lesson plans were used for the control group. And the second instrument was academic performance and retention test instrument named Nervous System Academic Performance Test (NSAPT) (50 Multiple Choices question items) for measuring the students' academic Performance and Retention of Nervous system of both groups. More so, in terms of instruments' validity, the Science education experts including Lecturers in Biology area from Department of Science and Vocational Education Usmanu Danfodiyo University Sokoto in addition to four other Senior Biology Teachers from Secondary Schools in Niger State as well as another one Team-Based Learning expert from the Department of Science and Technology Education, Federal University of Technology Minna performed face and construct validity of both TBLT and NSAPT. Furthermore, the Researcher used the Table of Specification (TOS) under the monitoring of those Experts to perform the content validity of the NSAPT.

Besides that, the validated NSAPT was tested and retested during pilot using the same population and environmental conditions of the study but outside the participating Sample. And the data obtained was used to establish internal consistency reliability coefficient using Crombach alpha where a reliability index of 0.77 was obtained. Moreover, the validated and reliable NSAPT was administered as Pre-Test to both Experimental and Control Groups to measure their Nervous system knowledge equivalence level, then followed by training and mock testing of Students on

TBLT using guides. That was followed by Treatment to the two research groups using TBLT and lecture method. Immediately after the treatment, it was followed by re-administration of NSAPT as Post-Test also to both research groups to measure their Nervous system knowledge performance. After two weeks, the reshuffled NSAPT was re-administration as Post Post-Test to the research groups to measure their Nervous system knowledge retention level. Data collated altogether from those group tests were subjected to both Descriptive statistics (mean & standard deviation) to answer the research questions while inferential statistical analyses (t. test) was used to test the Null hypotheses at 0.05 level of significant, using Statistical Package for Social Sciences (SPSS) version 20. And the analyzed data were presented in the tables 3, 4, 5 and 6.

4. Data Analysis and Results

All the research questions were answered by the Mean and Standard deviation.

Research Question 1

What is the difference in performance between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?

Table 3: Experimental and Control groups; Nervous System Performance Mean result

Group	Variable	N	Mean	Standard dev	Mean Diff.	Mean Gain
Experimental group	Team-Based Learning	63	57.68	9.05	15.03	21.68
Control group	Lecture method	72	42.65	6.36		

Source: fieldwork 2019

Table 3 revealed that experimental group, which was taught using Team-Based Learning, obtained the mean of 57.68 and Standard Deviation of 9.05, which are apparently higher than the mean and standard deviation of 42.65 and 6.36 respectively achieved by the control group. More so, the mean difference of 15.03 in favor of experimental group implies that experimental group performed better than control group at posttest. When the pretest mean of 36.00 is subtracted from Posttest mean of 57.68 it generated the mean gain of 21.68, which entails teaching nervous system using Team-Based Learning Method, has positive effect on Students' academic performance.

Research Question 2

What is the difference in retention between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?

Table 4: Experimental and Control groups; Nervous System Retention Mean result

Group	Variable	N	Mean	Standard dev	Mean Diff.
Experimental Group	Team-Based Learning	63	44.97	7.45	8.28
Control group	Lecture method	74	36.69	6.36	

Source: fieldwork 2019

Table 4 revealed that experimental group that was taught using Team-Based Learning, obtained the mean of 44.97 and Standard Deviation of 7.45, which are apparently higher than the mean and standard deviation 36.69 and 6.36 respectively achieved by the control group. More so, the mean difference of 8.25 in favor of experimental group implies that experimental group retained better than control group at post posttest. That entails teaching Nervous System using Team-Based Learning Method has positive effect on Students' academic retention.

Test of Null Hypotheses

All the Null Hypotheses were tested using Inferential Statistic which was parametric (T-Test) Statistical Technique.

Null Hypothesis 1

There is no significant difference in performance between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?

Table 5: Experimental and Control groups; Nervous System performance T-Test result

Group	Variable	N	Mean	Mean Diff.	Df	T-value	P-value	Decision
Experimental Group	Team-Based Learning	63	57.68	15.03	133	11.25	0.000	($\alpha > P$) Significant
Control Group	Lecture method	72	42.65					

Source: fieldwork 2019

@ $\alpha = 0.05$

Table 5 revealed that the two-tailed t. test result of 11.25 indicates statistically significant difference in Performance Scores between the Students taught Nervous System through Team-Based Learning and those taught using Lecture Method in favor of those in the Team-Based Learning Group. The result suggests that the method of instruction (treatment) using Team-Based Learning and Lecture Method produced the significant difference in Posttest Scores of the

Students. And by the decision, since P. value (0.000) is less than the alpha value of (0.05), hence Hypothesis 3 is hereby rejected at 0.05 level of significance and 133 degree of freedom.

Null Hypothesis 2

There is no difference in retention between Senior Secondary School Students taught Nervous System using Team-Based Learning and those taught using lecture method?.

Table 6: Experimental and Control groups; Nervous System Retention T-Test result

Group	Variable	N	Mean	Mean Diff.	Df	T- value	p. value	Decision
Experimental Group	Team- Based Learning	63	44.97	8.28	135	7.02	0.000	($\alpha > P$) Significant
Control Group	Lecture method	74	36.69					

Source: fieldwork 2019

@ $\alpha = 0.05$

Table 6 revealed that the two-tailed t. test result of 7.02 indicates statistically significant difference in retention Scores between the Students taught Nervous System through Team-Based Learning and those taught using Lecture Method, in favor of those in the Team-Based Learning Method Group. The result suggests that the method of instruction (treatment) using Team-Based Learning and Lecture Method produced the significant difference in Post posttest Scores of the Students. And by the decision, since P. value (0.000) is less than the alpha value of (0.05), hence Hypothesis 4 is hereby rejected at 0.05 level of significance and 135 degree of freedom.

5. Summary of Findings

1. Students taught Nervous System using Team-Based Learning performed significantly better than those taught using Lecture Method.
2. Students taught Nervous System using Team-Based Learning retained significantly better than those taught using Lecture Method.

Discussion of Findings

The findings of this study are hereby discussed in a sequential order:

Finding on Hypothesis one which is on the comparison of Team-Based Learning and Lecture Method on Biology Students' academic performance showed that Team-Based Learning and Lecture Method have significant effect on Nervous System performance, because Experimental Group Students taught Nervous System using Team-Based Learning performed better than those taught using Lecture Method. This finding is in agreement with the finding of Muraya and Kimamo (2011) studied the effects of Team-Based Learning approach on Biology mean achievement scores of Secondary School students and found that Cooperative learning approached students have

significantly higher achievement scores compared to regular lecture method. In addition, Nneka (2015) examined the effect of Team-Based Learning instructional strategy on Senior Secondary School Students' achievement in Biology. Furthermore, Kolawole (2008) who investigated the effects of the Cooperative and Competitive Learning on academic performance of students in mathematics and found that Cooperative Learning strategy is more effective than Competitive Learning Strategy. But on contrary side, this study is in disagreement with finding of Hossain and Tarmizi (2013) who found that Team-Based Learning method had no significant effect in improving students' academic performance in mathematics than lecture method.

Finding on Hypothesis two which is on the comparison of Team-Based Learning and Lecture Method on Biology Students' academic retention showed that Team-Based Learning and Lecture Method had significant effect on Nervous System retention, because Experimental Group Students taught Nervous System using Team-Based Learning retained better than those taught using Lecture Method. This finding is in corroboration with the finding of Chatila and Husseiny (2017) who studied the effect of Team-Based Learning Strategy on Students' Acquisition and Practice of Scientific Skills in Biology found that Team-Based Learning has a positive effect on students' retention in learning scientific skills in grade ten than lecture method.

6. Conclusion

From the findings of this study, the study concluded that the use of Team-Based Learning was more effective in teaching Nervous system in Biology than lectures method among Secondary School Students in Niger State.

Recommendations

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

1. Team-Based learning should be encouraged by the biology teachers to improve Biology Students' academic performance in Nigerian Secondary Schools.
2. Team-Based learning should be encouraged by the biology teachers to improve Biology Students' academic retention in Nigerian Secondary Schools.

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