

Effect of 5 Step Constructivist-Based Instructional Model on Students' Retention in Biology

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Abstract: *The study was carried out to investigate the effect of 5 step constructivist- based instructional model on student's retention in biology in Anambra state. Three hundred and eighty-five students were sampled using multi-stage sampling technique. Two weeks after post-test, retention test was given. The study adopted aquasi-experimental research design. The control group was taught using conventional method while the experimental group was taught using constructivist-based model. Data was collected using biology achievement test (BAT). Mean and standard deviation were used to answer the research question while analysis of covariance (ANCOVA) was used to test the null hypothesis at .05 level of significance. Data obtained revealed that there is significant different in mean retention score in favour of those taught constructivist – model, also male students gain higher than the female student. Based on the findings, recommendations were made among which is that teachers should apply constructivist-based steps when teaching abstract or difficult concepts because it will help students to construct their knowledge independently, and in gender friendly.*

Keywords: Achievement, constructivist, model, retention

1. Introduction

Science is systematic study of nature. Science may be thought as a set of processes on one hand and as product on the other hand. The product of science are the body of knowledge that results from the investigation such as laws, theories, principles, concepts and facts while process is the means of investigations by which the body of knowledge is acquired. According to Uzowuru and Egbeama (2015), science is a search for meaning or exploration of the events in nature. Both human and material resources are inevitable in the teaching and learning of science as it makes learning more meaningful.

The role of science, particularly biology in the development of a nation cannot be over emphasized. Biology is the key to economic, intellectual, sociological, human resources development and wellbeing of any society (Ezuike and Ayo vaughan, 2020). It occupies a unique position in the secondary school education curriculum because of its importance as science of life.

Many authors have acknowledged the use of constructivist teaching method in improving student's retention in biology. Constructivism is activity-based, students' centered and interactive learning strategy which upholds the view that knowledge should be constructed by the learners through active mental developmental processes (Ekoh, Asuguo & Udo, 2017). Constructivism which encourages students to collaborate and be more productive argues that learners do not passively acquire knowledge but actively construct meaning through their interpretative interactions with an experience in the world (Ihuarulam, 2012). Opara (2011) advocated the use of constructivism in teaching sciences especially biology because it promotes science process skill development, encourages active interaction between teachers and students, allow teachers/students to become askers, seekers, interrogators, questioners, ponders and combines all the learning processes that encourages

discovery, construction and retention of facts, without retention learning cannot take place.

Retention is a term used to describe the ability to recall learning outcome after a period of time. It is a measure of the rate at which students persisted in their educational programme in an institution and expressed as a percentage (Duyilemi and Bolajoko, 2014). For knowledge to be retained for long time by the learners, the teachers must use effective instruction in the classroom to allow students interaction. According to Ekoh, Asuguo and Udo (2017), constructivist based-instructional model is the one that encourages students' retention, active participation in teaching and learning process. It is all inclusive for the teacher and students, which may be suitable for teaching biology especially those concepts that seem difficult to comprehend like cellular respiration, cell reaction to its environment and others (Okoli, 2013; Ihejiamazu, Ukor & Neji, 2018). Retention is considered as being able to hold onto information for a considerable length of time. Hence, retention test can be administered about two weeks after instruction (yuruk, 2007). Retention in students can be improved by repetition and practice. The issue of gender retention in science has been a burning issue in science. This problem is even compounded by the fact that most science educations give masculine outlook to science subjects and some pointed out that gender has no influence rather they achieve equally when giving equal opportunity. Since constructivist is acknowledged as the best innovative method of teaching, there is a need to try such innovative teaching strategy to see how gender will influence student's retention in biology. It is against this background that this research was carried out in order to establish the effect of 5 step constructivist-based instructional model on students' retention in biology.

Statement of the Problem

Different studies have revealed that science classroom environment and activities influence students' retention. Poor academic retention of science students especially in

biology at senior secondary school certificate examination by Nigeria students had been a cause of concern for biology teachers and other stake holders in education. This has been blamed on many factors especially the way biology is being taught in schools. Literature revealed that the predominant method used by teachers does not allow active participation of students. It is against this background that this study sought to find out the effect of five step constructivist-based instructional model on secondary school students' retention in biology.

Objective of the Study

The objectives of the study are as follows:

- 1) To determine mean retention scores of students taught biology using 5 step constructivist-based instructional model and those taught using conventional teaching model (CTM).
- 2) To find out means retention scores of male and female students taught biology using CBM.

Research Question

The following research questions were answered:

- 1) What are the mean retention scores of students taught biology using constructivist-based instructional model (CBM) and those taught using conventional teaching model (CTM).
- 2) What are the means retention scores of male and female students taught biology using CBM.

Hypothesis

H0₁: There is no significant difference in the mean retention scores of students taught biology using CBM and those taught using CTM.

H0₂: There is no significant difference in the mean retention scores of male and female students taught biology using CMB.

Research Design

The research design used in this study is the quasi experimental research design. This is because randomization tended to disrupt the school activities.

Population

The population of the study comprised 138, 910, SS1 Biology students (18, 272 males & 120, 637 females) in all the 150 co-educational secondary school in six education zones of Anambra state.

Sample Size and Sample Technique

The sample of the study was made up of a total of 385 seniors secondary I biology students and was drawn from the six education zones that were chosen for the study, sampling was done in stages. Firstly purposive random sampling technique was use to select two co-educational schools from the six education zones. Then the next stage was simple random sampling technique to select six schools for experimental and six again for control groups, while the third stage was the use of simple random sampling again to select intact classes from each of the schools. All the students in each of the intact classes were used for the study. The experimental group was taught the selected biology concept using the 5 step constructivist-based instructional

approach while the control group was taught the same concepts using the conventional lecture method.

Instrument for Data Collection

The study was carried out using one instrument; Biology Achievement Test (BAT) two weeks after post-test, retention test was given to students. The face validity and reliability of the instrument was equally obtained. Kuder Richardson k-20 formular was used and 0.77 reliability coefficient was obtain.

Again difficult index was carried out and 93.8% was obtained, meaning that most items fell within acceptable range and fit for any predictive purpose. Also, 63.1 discrimination index was obtained which signifies that most item are within excellent range.

Data analysis

Descriptive statistic using mean and standard deviation were used to answer research questions while Analysis of Covariance (ANCOVA) was used to test the hypothesis at.05 levels of significance using SPSS version 20.0.

2. Results

The results of the data analysis were presented in the table in line with the research hypothesis.

Research Question 1: What is the mean retention scores of students taught biology using CBM and those taught using CTM.

Table 1: Mean Retention and Standard Deviation Scores of Students Taught Biology using Constructivist-based Instructional Model and Conventional Teaching Model.

Approach	N	Mean Retention	SD
CBM	176	59.54	6.52
CTM	209	50.10	6.73

Table 1: Shows that the mean retention score of students taught biology using constructivist-based instructional model is 59.54 while their counterpart taught using conventional teaching model had a mean retention scores of 50.10. This shows that the mean retention score of students taught biology using constructivist-based instructional model was greater than that of those taught using convention teaching model. This shows a difference in mean retention scores of 9. 44 in favour of those taught using CBM.

Research Question 2: What is the mean retention scores of male and female students taught using CBM?

Table 2: Mean Retention and Standard Deviation Scores of Male and Female Students Taught Biology Using Constructivist-based Instructional Model

Approach	Gender	N	Mean	SD
CBM	Male	73	64.78	4.49
	Female	103	55.83	5.00

Table 2 shows the mean retention scores of male and female students taught biology using constructivist-based

instructional model to be 64.78 and 55.83 respectively. Male students gained higher than the female students.

Hypothesis 1: There is no significant difference in the mean retention scores of students taught biology using CBM and those taught using CTM.

Table 3: Analysis of Covariance of Students' Mean Retention Scores in Biology

Source	SS	Df	Ms	F	P
Pre-test ^a	459.61	1	459.61	10.70	.001
Group	7171.48	1	7171.48	166.99	.000
Error	16404.99	382	42.945		
Total	1165384.00	385			

Table 3 Shows that there is a statistically significant difference in mean retention scores of secondary school students taught biology with constructivist-based instruction model and those taught using conventional instruction model. $F = 166.99$ and the obtained P-Value (.000) is less than the stipulated level of significance (.05). the null hypothesis of no significant difference between the two groups was therefore rejected.

Hypothesis 2: There is no significant difference in the mean retention scores of male and female students taught biology using CBM.

Table 4: Analysis of Covariance of Male and Female Students Mean Retention Scores in Biology

Source	SS	Df	Ms	F	P
Pre-test	783.359	1	783.35	19.16	.001
Gender	7964.15	1	7964.15	194.86	.000
Error	15612.31	382	40.87		
Total	1165385.00	385			

Table 4 shows that the mean retention scores of male and female biology students differs significantly using constructivist-based instructional model and conventional instructional model. $F = 194.86$, the obtained P-value (.000) is less than the stipulated level of significance (.05). The null hypothesis of no significant difference between the two groups was therefore rejected.

3. Discussion of Findings

From the results, it was found out that there exist a significant difference between the retention abilities of students taught biology with constructivist-based model and those taught with conventional.

The result showed a difference in mean retention score in favour of those taught constructivist-based model. On gender, Ajo-Okorie and Akumah (2013) were of the view that males performed better than females in sciences. Though the gender issues and its effect on student's academic retention of science concept has persisted over the years with contradictory results. However, this research revealed a difference in mean retention scores of male and female students taught biology using a 5-step constructivist-based model in favour of male students in line with the findings of Ajo-Okorie and Akumah. The result is consistent with the finding of Bigem, Kalender and Senigu (2012) who

obtain result indicating that constructivist approach enhance meaningful learning among students and grant them opportunities to apply their knowledge in a new situation which help in retention of knowledge gained.

Also, Amos, Akawo, Eli and Queen (2014) obtained result indicating that video-based multimedia instruction facilitated meaningful learning and retention of biology concepts. This according to them might be due to the stability and clarity of ideas which is provided in the cognitive structure of the experimental group of biology students. It could be also for the fact that in a constructivist-approach, learners construct knowledge through real life experience as cognitive activity rather than simple learning from abstract concept.

4. Recommendations

From the study, the following recommendations were made;

- 1) Teachers are advised to apply constructivist-based steps when teaching abstract or difficult concepts because it will help students to construct their knowledge independently.
- 2) Biology teachers are also advised to use constructivist teaching approach because it is gender friendly.

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