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Effect of Instructional Models on Retention of Biology Concepts among Secondary School Students in Ogoja Education Zone, Cross River State, Nigeria

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Abstract
The purpose of the study was to determine the effect of instructional models on retention of biology concepts the digestive system among secondary school students. A research question was raised and one hypothesis formulated to guide the study. The population of the study comprised all the SS II Biology students in the 88 public secondary school in Ogoja education zone. Multi – stage sampling approach involving simple random stratified and purposive sampling technique was used to select 127 subjects for the study. The research design adopted for the study is a quasi-experimental non-randomized factorial design using a pretest-posttest control group for the study. A Biology retention test with 50 items multiple choice questions was the instrument for data collection, administered to 125 senior secondary school two Biology students. The reliability of the instrument was obtained at 0.79 using Kuder Richardson Formula (KR-20). Analysis of covariance was used and the result showed that students taught Biology concepts using instructional models had a higher mean score than those taught without instructional models, biology teachers should incorporate instructional models as key component in the teaching-learning process.

Keywords: instructional models, biology, retention, and secondary school students.

Introduction

Science explains the natural existence of man and his activities. It could be seen as problem solving in order to improve the living standard of man. On the other hand, education is what happens to a man from the day he is born to the day he dies (Okafor, 2010). It is also the process of receiving or giving systematic instruction, especially at a school. Education is characterized as a learning cycle for the person to achieve information and comprehension of the higher explicit items. It is the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and generally of preparing oneself or others intellectually for mature life. (Huge, 2019). According to Onete (2018) education is the process of gaining knowledge through instructions.

Science Education according to Okafor (2014) is the field of science that is concerned with sharing of science content, and the process of teaching science pedagogy in order to provide expectation of understanding part of the scientific community. According to Owolabi (2012) Science education provides the knowledge and skills necessary to promote economic, scientific and technological development. Science education is very important to the development of every nation. This explains why every nation must take it very seriously in all institutions of learning. Owolabi (2014), many of the developed nations were able to achieve so much in science and technology because of science education.

Biology is one of the core aspects of science education, a field of natural science that concerns the study of all elements relevant to life (Ada, 2018). Biology is the branch of science that primarily deals with the structure, function, growth, evolution and distribution of organisms. As a science, it is a methodological study of life and living things, (Jones & Ukeh, 2017). biology is one of the science subjects offered at the senior secondary schools. It attracts the greatest number of both science –oriented and arts-based students. Most of the students choose biology because it is considered as the easiest science subject when compared with Chemistry and Physics (Njoku 2015). Biology as a key science subject deals with the study of plants and animals. The major branches of biology are botany and zoology.

The importance of Biology has been recognized in the development of drugs and vaccines for prevention and treatment of diseases. (Ada 2018) More so, the knowledge of biology helps in the improvement of new plants species and animal breeds, (Crowle, 2018). Though Biology is fundamental to several professional courses like medicine, pharmacy, nursing and others, there has been persistent poor achievement in biology among secondary school students in Nigeria (Nwafor 2014; Ihejiamaizu, 2019).

The relative poor achievement in biology has been attributed to so many factors, that include the abstract nature of some Biological concepts, (Limer,2012, Agboroma & Oyeovuli,2015 Etobo & Fabinu, 2017, (Lebata &Mudu 2014), poor reading habits, Overloaded curriculum (Zeidan, 2010) inadequate provision and utilization of models by biology teachers. Meaningful learning is deemed to have taken place if after a passage of time the student can recall and apply information learnt in examinations as the case may be. And this takes place when learning is coded into memory. Iwuji (2012). Thus, the appropriate coding of information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane. Iwuji (2012) also posited that the nature of the materials to be coded contributes to the level of retention. The National Association of School Psychologists NASP (2003) reported the low level of retention of concepts amongst students to be alarming and persistent that it urges

schools and parents to seek alternative ways of boosting retention level amongst students that will more effectively address the specific instructional needs of academic underachievers.

Retention is key in the full appreciation of biological concepts. Iji (2003) asserted that man is endowed with limited capacity for memorization and to correctly and effectively use or apply whatever one has learnt, retention must come to play an important role. Battista (2007) in his work attested that understanding biology concepts is dependable on students' retention ability, thereby emphasizing the need of developing and enhancing students' retention ability in order to facilitate their learning and understanding of biology. Oyarole (2016) posited that for students to retain the information taught, they must see the meaning or purpose for that information. The students must also understand and be able to interpret and apply the information. This understanding includes their ability to assign the correct degree of importance to the concepts learned. The amount of retention is directly affected by the degree of original learning of concepts perceived as difficult concepts.

The relatively poor achievement in biology may be directly linked to poor retention of concepts on the part of students (Lebata & Mudu, 2014). Inspite of various efforts by government, teachers, curriculum planners, and others to enhance retention, low retention of biology concepts amongst students still persist Lebata (2014).

According to Yero (2010) models are teaching aids or materials used to illustrate the teaching process and to make instruction concrete and more comprehensive to the learner. They are representations of an idea, object, event, process, or system. Models are very important teaching aids for science and biology in particular. They help in simplification of complex ideas; this is by clarifying the structure of a complex phenomenon by reducing it to simpler and more familiar terms. Instructional aides are devices or pieces of equipment, graphics or sound representation or illustration that help learners learn. Yero (2010) categorized instructional materials into visual aids, auditory aids, and audio-visual aids.

1. Visual Aids: these include chalk board, posters, bulletin, displayed models, motion pictures, slides, projected transparences, flip chart etc. In fact, they represent all the materials the eyes can focus and is used by the teacher or instructor in delivering the lesson to the students.
2. Auditory Aids: These include record players, tape recorders, and language laboratory, all that appeals to the sense of hearing.
3. Audio-Visual Aids: These include aids that make use of both sight and hearing such as sound motion, pictures, slides on sound television.

Besides the use of models by biology teachers, past researchers for example Okeke (2017) revealed that there are other factors that could influence academic achievement, these may include gender. The influence of gender on achievement in biology and science in general has been a concern for education researchers for long.

According to Hornby (2019), retention is the capacity for memory. Also, retention is the ability to reproduce the learnt concept when the need arises (Danirel, 2004). For the sake of this study, retention is defined as the ability to retain or remember the biological knowledge one has learned and to be able to retrieve it when needed. It is interesting that effective instructional models—rather than rote memorization—are what help students retain information in biology (iji, 2002; Chiason, 2008). Mkpa (2008) in Iji (2010) stated that retention is the continued capacity to behave the way that has been learned. Also, Obodo (1999) in Iji (2010) asserted that retention is measured in collaboration with achievement. However, students' retention could be retained using an appropriate instructional model in teaching. Using instructional models, learning could be made more effective, lasting, and enjoyable and topics or concept that are abstract to students could be made clearer, easier and meaningful for better retention in the concept learnt.

Purpose of the Study

The purpose of the study is to determine the effect of models on students' retention of concepts in Biology in Ogoja Education zone of Cross River State Nigeria.

Specifically, the study sought to find out the

1. Effect of the use of models on students' retention of concepts in biology.

Research question

The following research question was used as a guide to the study:

1. What is the effect of the use of instructional models on biology students' retention in biology?

Research hypothesis

The following hypothesis were formulated to guide the study:

1. There is no significant difference between the mean retention scores of biology students taught using instructional models and those taught without instructional models.

Methodology

The study employed a quasi-non-equivalent, non-randomized factorial design. One treatment variable and one moderator variable make up the modified pretest posttest retention test control group design. The factorial design was preferred because it allowed the assessment of the effect of each independent variable separately as well as their interaction effect (Onwioduokit, 2000). The experimental group was taught using instructional models while the control group was taught without instructional models. The 2x2 factorial design is simply:

Y_1 O_1 x_1 0_2 0_3 E
O_1 x_2 0_2 0_3 C

Table 1: Population distribution of SSII Biology students in public secondary schools in Ogoja Education Zone in Cross River State.

LGA	No of schools	No of biology students		Total
		M	F	
Ogoja	20	298	322	620
Yala	19	289	300	589
Bek wara	13	282	150	432
Obudu	22	196	492	688
Obanliku	14	187	309	496
Total	**88**	**1252**	**1573**	**2825**

Source: Planning, Research and Statistics Department, Secondary Education Board, Cross River State Ministry of Education Calabar (2019)

Hypothesis one:

There is no significant difference between the mean retention scores of biology students taught using instructional models and those taught without instructional models.

Independent Variable:	Treatment
Dependent Variable:	Retention ability
Statistical Technique:	Analysis of covariance (ANCOVA)

Results

Research question one

What is the effect of the use of instructional models on students' retention in digestive system? In answering this research question, mean and standard deviation was used. The result of the descriptive statistics was presented in Table 2. The result as displayed in Table 2 indicated that the experimental group (instructional model) had a higher retention mean score of 38.07 than the control group that had a mean of 19.48. The standard deviation was 4.96 and 1.88

respectively. The research question seeking for the effect of instructional models on the retention ability of senior secondary school

Table 2: Mean and standard deviation of retention scores.

Groups	**Mean**	**Standard deviation**	**N**
With instructional models	38.07	4.96	77
Without instructional models	19.48	1.88	50
Total	30.75	9.97	127

Hypothesis two

There is no significant difference between the mean retention scores of students taught digestive system using instructional models and those taught without instructional models. The result of the analysis was presented in Table 4.

The result of the analysis as shown in Table 4 indicated a high significant F (1,124) of 635.050, P<.05 for treatment **(**use of instructional models**).**

Table 3: Summary of analysis of covariance of influence of treatment on SS2 biology students' retention level in digestive system.

Source	Type 111 Sum of Squares	df	Mean square	F	Sig.	Partial Eta squared
Corrected Model	10474.475[a]	2	5237.238	318.426	.000	.837
Intercept	4349.552	1	4349.552	264.454	.000	.681
Pretest	3.694	1	3.694	.225	.636	.002
Treatment	10444.838	1	10444.838	635.050	.000	.837
Error	2039.462	124	16.447			
Total	132585.000	127				
Corrected Total	12513.937	126				

a. R Squared = .837 (Adjusted R Squared = .834) *P<.05

Table 4: Summary of multiple classification analysis of biology students' retention on digestive system by experimental and control groups

Grand measure	Mean =30.75 variable + category	N	Unadjusted deviation	Eta	Adjusted for independent Y covariates deviation	Beta
Method Retention achievement	Treatment					
	1	77	7.3169	.837	7.32	.915

2	50	-2.268	-2.27	
R^2				.837
R				.834

The null hypothesis which speculated that there is no significant difference between the mean retention scores of students taught digestive system using instructional models and those taught without instructional models was rejected and the alternate hypothesis was accepted. This was because the p value calculated was less than 0.05 (P<.05). The implication of this result is that there was a significant difference between the retention scores of SS2 students taught biology with instructional models and those taught without instructional models.

Examination of Table 3 showed that 83.7% (.837) of the total variance was accounted for by treatment effect (instructional models). This further reinforces the fact that the subjects in the experimental groups (students taught with instructional models) retained more concepts in biology than control groups (students taught without instructional models).

The experimental groups, (taught with instructional models) were found to be superior in biology achievement than the control groups taught biology with instructional models as shown in Table 10 where the experimental groups had a mean retention score of 38.07 which was higher than the control group that had a mean of 19.48.

Discussion of Findings

The hypothesis sought to find out if there is any significant effect of teaching with and without instructional models on the retention level of SS2 biology students. In this study, it was found that students taught digestive system using instructional models retained more biological concepts than those taught without instructional models. The analysis of covariance showed a significant difference in the result as the calculated F-value of 635.050 P<.05 for treatment **(**use of instructional models**).** The significant difference therefore implies that instructional models were responsible for high retention of biological concepts. This so as students interacted with the instructional models, and it will take a long time for them to forget what they saw and touched with their hand. This would have been responsible for the high retention mean score of students in the class that used instructional models. This agrees with the study of Iji (2003) that determine the effect of instructional models on SS1 students' achievement and retention in biology. Six research questions were asked and six hypotheses were formulated to guide the study. The study employed a quasi – experimental non – equivalent control group time series design. A sample of 285 SS1 students was purposively drawn from three secondary schools in Ahoada education zone of Rivers state. Two instruments were used for the study. These were biology achievement test (BAT) and the biology retention test (BRT). The research questions were answered using mean and standard deviation while Analysis of covariance (ANCOVA) was employed to test the hypotheses at 0.05 level of

significance. The study among other things revealed that students in experimental group performed better than their colleagues in the control group and also the experimental group students' retention scores of the content of biology significantly differ from the scores of the control group.

The significant level of the effect of instructional models on the retention level of students according, to this study is not farfetched. This is not unconnected with the saying; "what I hear I will forget, what I see I may remember, but what I do I will never forget" Since students touched and interacted with instructional models, they could visualize the models thus, leading to a high retention level.

The finding of this study was consistent with Iji (2003) who studied the effect of instructional material SS1 students' achievement and retention in digestive system. The study showed, among other things, that students in the experimental group fared better than students in the control group and that students in the experimental group retained more information about the biology contents than students in the control group.

This study was also supported by the findings of Eze's study of 2008 demonstrated that students who were taught using instructional models retained knowledge substantially more than those who were not. Also, Ugwuanyi (2009) that was aimed at finding the effect of instructional models on SS1 students' achievement and retention in digestive system. According to the study, students who learned about biology concepts using instructional models performed better on tests and retained more information than those who did not.

Conclusion

Based on the findings from the study, it is glaring that adequate provision and utilization of instructional models is critical for the purpose of improving students' retention of concepts in biology. Instructional models positively influenced students' retention. Therefore, Biology, being such an important subject for the physiological and morphological function of the human body and socio-economic development of the society, deserves adequate attention using appropriate instructional models for the teaching and learning of the subject.

Recommendations

In view of the findings of this study, the following recommendations were made:

1. Instructional models should be adopted as the major instructional models for teaching digestive system in schools.
2. Professional Association like Science Teachers Association of Nigeria (STAN) should popularize the use of instructional models in teaching difficult biological concepts through seminars and workshops.
3. Government and stakeholders in the education industry should regularly organize workshops and seminars for in-service teachers of the rudiments

and ultimate familiarity in the use of instructional models in teaching Biology in secondary schools.

4. Biology teachers should incorporate instructional models as a key component in the teaching-learning process.
5. Government should as a matter of priority, make adequate provision for necessary facilities in schools. Ensure that instructional models are sufficiently provided in schools.

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