UTIIZATION OF BIOLOGICAL MODELS ON STUDENTS' ACADEMIC ACHIEVEMENT IN SECONDARY SCHOOLS IN IKA LCAL GOVERNMENT AREA, AKWA IBOM STATE, NIGERIA

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Abstract

The study determined the utilization of Biological models on students' academic achievement in biology in Ika Local Government Area, Akwa Ibom State, Nigeria. One research question and three hypothesis guided the study. The design of the study was Quasi-experimental design. The sample of the study used was one hundred and twenty senior secondary three (SS2) students offering Biology in Public Secondary Schools in Ika Local Area, Akwa Ibom Purposive sampling technique was employed to select a total number of (120) respondents as sample of the study. The instrument for data collection was Biology Achievement Test (BAT) validated by three experts in Science Education and educational foundations. The reliability of BAT was established using Kuder-Richardson Formula (KR-20) which yielded a reliability coefficient of to be 0.81. Research question was answered using mean and standard deviation while analysis of covariance was used to test the null hypothesis. The result of the study showed that students taught using Biological models had higher mean achievement score than those taught using conventional instructional method. It was concluded that the use of biological models is an effective instructional approach for improving students' achievement in biology. It was recommended among others that biology teachers should be adopt the use of realia biological models to aid teaching and learning.

Keyword: Biological models, Academic Achievement, Biology

Introduction

Globally, education has proven to be the bedrock of development. Education plays a critical role in long-term productivity and growth at both micro and macro levels. Igwe (2021) holds the view that government investment and total expenditure on education are the only outlay that remains significantly associated with growth. In other words, the development of any nation is traceable to its repertoire of human capital which normally entails education and health. This explain why the state of education in Nigeria continues to be a national discourse at all levels.

Biology occupies in our lives as well as its significant role in the scientific and technology advancement of the nation, it remains a subject for which students' performance over the years (especially between the eighties till date) have been reportedly, deplorable and miserable (Ugu &Yaro, 2022; *Bessong et al, 2024*). It has been observed that secondary school students in Ika Local Government Area has witnessed an incessant fall in the academic performance of students in Biology both internal and external examinations. The increasing nature of poor academic performance in Biology of public secondary schools students especially in external examination like West African Senior Examination Certificate (NECO) or Joint Admissions and Matriculation Board (JAMB) had been the major concern to all the stakeholders in education although some students perform better than others in the same school (Alebiosu, 2019). Instructional models such as biological model are realia materials that visible to the students use of organs of sight and touch and capable of influence learning and makes it more learner engaging. Biological models just like any instructional materials are very vital because

they aid teaching and learning and contributes to knowledge structure of the learner and therefore promote reflective thinking in more critical and creative manner. If students can see a clear organized picture of a skeleton and other models with various concepts, then they will build a deeper understanding and appreciation of these concepts. Therefore, a model is a physical representation of an idea, phenomenon or system that helps to make concrete and abstract topics more real and enrich learning Models sometimes appears smaller than the original or real object which they represent. Mastery of biology Concepts cannot be fully achieved without the use of biological models. Models stimulate learners interest, help the teacher and the learner to overcome physical limitation during the presentation of the subject matter. It also helps teacher to meet individual differences of the learners in the class by using aids that appeal to different senses (Inyang, 2022, Folade & Bashi, 2023; *Olofu et al, 2024;* Bessong et al, 2024). Models are also used to supplement vital explanation of concept or any description so that the lesson could be real to the students. The absence of these materials in teaching Biology could discourage learning thereby leading to low or poor academic performance of students. Instructional models are very important because what students hear can easily be forgotten but what students see cannot be easily forgotten and last longer in their memory. The benefits of Biological Models during teaching and learning in the classroom are enormous. For instance, visual instructional models help learners clarify thoughts and information, reinforce understanding through connections, assist learners to integrate knowledge with prior learning (Obi et al, 2019; Adie et al, 2019, Olofu et al, 2022).

Literatures despites the efficacy of learning models which assist learners learn optimally when utilised .. This is an acknowledgement of the role of instructional models in effective teaching and learning process. Biological models here include all the materials which appeal to the senses and which enrich learning, such projected still pictures, motion pictures, audio materials and three-dimensional material (models, realia, mock-ups, or dioramas). Researchers and educationists maintain that no other group of teaching aids could compete with realia (real objects) and models (scaled representation of real materials or objects) in fascinating learning and retention of concept learnt (Gbamanja, 2008, Oboqua et al, 2019). According to Ezema and Esoma (2022), the best approach in the teaching of particular concept or phenomenon is the presentation of the real objects in the learning units as teaching facilities, such as real specimens and real machines or tools as they are known to exist or used in life situation. However, in the absence of the real objects, models could be used to facilitate teaching and learning of Biology (Adie, et al, 2019; Olofu et al, 2022).

Models are the nearest semblance or likeness of an observable object. The less abstract the object, the nearer the model is to reality (Eshiet, 2009, Adie et al, 2018). Models are scaled, 3-dimensional concrete representations of observable abstract concepts, with particular reference to the perspective of size and shape, which provide the sensation of "feel" which is often absent in 2-dimensional materials such as graphics and projected visual aids. Specific advantage of models includes the possibility of making them larger, smaller or often same size as the object to be represented, and providing learning experiences which real objects such as colours and interior views, cannot provide (Ziden; Ismail; Spian & Kumutha 2021, Olofu et al 2023; Inyang, 2022). Models play a key role in the interpretation of science and help to understand complex concepts easily. Besides, they support students in producing new and creative ideas.

Biological models are the equipment, objects, representation of realia materials that can be used the most effectively in biology teaching. The materials that teachers use in educational environments help them to establish communication with students. It is doubtless that the communication established by the teacher in learning is very important (Zappola, 2021). A creative teacher can make models for his teaching or guide the students into making different models for teaching/learning purposes.

Generally, models have the advantage of presenting objects in three-dimensional form thereby presenting a better picture of reality of concept than two-dimensional pictures. When students participate in constructing models, their creative abilities are enhanced, and they get the excitement of achievement. They also provide source of amusement and entertainment to the students (Olofu, et al, 2022; Kankpang et al, 2022). They facilitate learning by stimulating and drawing the attention and interest of the students. In a classroom context, students refine their own mental models as they observe, analyze, and discuss the modeling work of others. According to Kingsley (2020), the internal representations that comprise mental models are tightly linked to reasoning associated with understanding and interest in learning. To make teaching and learning more concrete and thorough for the student understanding and interest, instructional models are teaching tools or resources that are used to depict the teaching and learning processes.

i. Models enable the instructor to use items even when the real item is impractical due to size
ii. Models can be purchased from commercial firms or they can be home made by the instructor and/or the students.

Model are near-perfect replicas of the real things. They are either reduced in scale or enlarged in scale. Examples of models includes: skeletal system, cell, kidney, DNA, heart, the brain, female reproductive system etc. as shown in the figures above. The availability and utilization of Biological Models enhances effective teaching and learning. Hoskinson; Oki; Oroki and Olup (2014) noted that Central to the education process are educational resources which play an important role in the achievement of educational objectives and goals by enhancing effective teaching and learning. Aliyu and Ezeawanyi (2021), availability of instructional materials such as biological models strengthen the idea by actively involving and motivating students and teachers learning process. The use of adequate learning facilities promotes students learning habits.

Agboghoroma (2019) also stated that availability and usage of Biological Models offers reality of experience, provides visual aspects to the process or technique and facilitate the understanding of abstract concepts, saves time by limiting use of wordy explanations and provides opportunity for the learners to manipulate objects in the learning environment. According to Okonkwo (2019) the utilization of learning model is important for effective execution of any assigned task. Biological models aids learners to engage in self directed, learning experience through activities; thus enhance Students Academic performance in Biology. Similarly, Lemchi (2011) noted that the use of inadequate materials for teaching does more harm than good to the students. This is because where teaching materials are effectively utilized, learning becomes concretized, retention is also enhanced and interest of leaner's captured. Therefore, it is the evident that, adequacy and proper utilization of teaching resources affect Students academic performance. Biological models besides being of quality must be adequate and utilized.The effect of instructional models and students' understanding of biology concepts in Jos state was also examined by Ugu and Yaro (2022). The study explored quasi-experimental, non-equivalent control group design.

Richman and Luck (2019) conducted research to investigate the effect of instructional models on students' learning understanding in Biology in South Africa. The study employed a survey design in which a sample of 300 students were selected from 5 schools purposively selected for the study. Three research questions were raised which was transformed into three null hypotheses for the study. The major instrument used was questionnaire. The result of the finding using Simple Linear regression show that the use of instructional modeling significantly influence students understanding of Biology concept.

Anamez (2020) conducted a survey research study on the influence of learning models on students' understanding of Biology in selected secondary schools in Ghana. A sample of 800 students were selected from 13087 students for the study. Four research questions were raised which was transformed into four null hypotheses for the study. The major instrument used was questionnaire, performance test. The reliability of the instrument was established using Chronbach Alpha which ranges from .83 to.89. The result of the analysis using Pearson Product Moment Correlation how that there is a significant relationship between learning modeling and students understanding of Biology concept.

Victor (2019) conducted a survey research study on the influence of learning models on students' interest in Biology in selected secondary schools in Abia State, Nigeria . A sample of 650 students were selected from the population of 7,765 students from selected 8 public schools for the study. Four research questions were raised which was transformed into four null hypotheses for the study. The major instrument used was questionnaire, and achievement test. In Biology The reliability of the instrument was established using Chronbach Alpha which ranges from .74 to.82 for the questionnaire while achievement test was established using Richard Kuder K 20 which gives .88. The result of the analysis using Simple Linear Regression amongst other research hypotheses show that there is a significant influence of modeling on students' interest in learning Biology concept.

Problem Statement

The underachievement of Biology students in senior secondary school certificate examination in Nigeria especially in Ika Local Government Area in Akwa Ibom State has become worrisome situation that demands urgent attention. The poor academic achievement in biology may be attributed to inadequate use of instructional models and poor teaching approaches in content delivery. It is on this premise that this research is meant to find out if the use of biology models affects students' academic achievement in biology

Purpose of the study

The study investigated the use of Biological models on students' academic achievement in biology in Ika Local Government Area, Akwa Ibom State, Nigeria. Specifically, the study seeks to find out if; Biology students taught with Biological models differ in academic achievement with those taught without biological models in Biology

Research questions

What is the mean difference between students' academic achievement taught with and without Biological models?

Research hypotheses

There is no significant difference between students' academic achievement taught with and without the use of Biological models

Methodology

The study employed a quasi- experimental 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 2x2 factorial design.

The research area is Ika Local Government Area, Akwa Ibom State, Nigeria. The population of the study comprised of all SS2 students in Ika Local Government Area, Akwa Ibom State. The sampling technique adopted was purposive sample because the students were taught intact. The research instrument used for data collection was a 30 item multiple choice (MCQ) based on biology content taught to students in both experimental and control groups. Reliability of the instrument was ascertained using Kudar-Richardson's formular (KR-20). The treatment involved one experimental and one control groups. The experimental group was taught

biology content selected from SS2 syllabus (Parts of the human system and the respiratory organs). Data obtained was anlyzed using analysis of Covariance (ANCOVA). The research questions were answered using descriptive statistics while the hypotheses were tested using (ANCOVA). Results of data analysis are presented in tables below

Presentation of Results

Research question one Research Question 1:

What is the difference between the mean academic achievement scores of students taught with and without the use of biological models in biology?

Table 1: Mean and Standard deviation of pretest and posttest scores of students taught using biological models and those taught using control method

Variable		**Pretest**		**Posttest**		
Methods of Teaching	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	**Mean gain**
Use of Biological Models	100	19.53	8.50	28.98	11.99	4.45
Control Method	100	11.48	3.16	18.50	6.22	0.02

Results in table 1 show that experimental group taught using biological Models had a pretest mean of 19.53 with a standard deviation of 8.50 and a posttest mean of 28.98 with a standard deviation of 11.99. The difference between the pretest and posttest mean was 4.45. The group taught Biology using control method had a pretest mean of 18.48 with a standard deviation of 6.16 and a posttest mean of 18.50 with a standard deviation of 6.22. The difference between the pretest and posttest mean was 4.43. However, for each of the groups, the posttest means was greater than the pretest means with the group taught using biological Models having a higher mean gain. This is an indication that biological Models has more effect on students' achievement in biology than the control method.

Hypothesis 1

There is no significant difference between academic achievement scores of students taught with and without biological models.

Table 3: Analysis of Covariance (ANCOVA) of the mean achievement scores of students taught using biological models and those taught using conventional method

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	19914.386[a]	2	9957.193	171.889	.000
Intercept	18722.891	1	18722.891	323.209	.000
Methods	12522.055	1	12522.055	216.165	.000
Pretest	104.888	1	104.888	1.811	.180
Error	10832.566	87	57.928		
Total	179539.000	98			
Corrected Total	30746.953	99			

The results in table 2 shows that the significant difference in the mean achievement scores of students taught Biology using biological Models and those taught using control methods. Results show that with respect to the groups taught biology using Biological Models and those taught using control method, an F-ratio of 216.17 was obtained with associated probability value of 0.000. Since the associated probability value of 0.00 was less than 0.05 set as level of significance, the null hypothesis (H_{01}) which stated that there is no significant difference between academic achievement scores of students taught with and without biological models in biology is rejected. Thus, inference drawn therefore is that there is a significant difference between academic achievement scores of students taught with and without biological models in biology with those taught using biological models having a higher mean gain.

Discussion of Findings

Biological models and academic achievement in biology

The findings in table 1 indicated that biological Models has more effect on students' achievement in biology than the control method. In the test of hypothesis one in table 2 it was found that there was significant difference between the mean academic achievement scores of students taught with and without biological models in biology with those taught using biological models having a higher mean gain. The result supported the findings of Charles and King (2018) found that instructional models significantly influence students' biology understanding. Gabriel, Osuafor, Nwanze, Obinna and Emenihioma (2018) also found that there was a significant difference between the mean achievement sure of students and those without using instructional paradigms to facilitate understanding learning. Richman and Luck (2019) found that the use of instructional modeling significantly influence students understanding of Biology concepts.

Conclusion

The use of biological models significantly contributes to the variance in students' academic achievement in biology

Recommendations

The study's conclusions have led to the following recommendations:

1. The integration of biological models into biology teaching should be promoted to enhance students' academic achievement
2. Improvisation of models should be encouraged by teachers to promote teaching and learning

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