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# EFFECT OF INSTRUCTIONAL MODELS ON ACHIEVEMENT AND 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 achievement of Biology concepts the digestive system among secondary school students. To achieve the purpose of the study, a research question was raised and one hypothesis formulated to guide it. Empirical review was in line with the variables of the study. The population of the study comprised all the SS II Biology students in the 88 public secondary school in Ogoja education zone. 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 achievement 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 a key component in the teaching-learning process.

**Keywords:** Instructional Model, Achievement, Retention, Biology, Secondary School

## Introduction

The natural existence of man and his activities are explained by science. It might be viewed as problem-solving aimed at raising humankind's standard of living. 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 the 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. Every country's progress depends heavily on science education. This explains why it must be taken extremely seriously in all educational institutions by every country. According to Owolabi & Etuk - Iren (2014), science education has been a major factor in the advancement of many industrialized countries in science and technology.

The study of life is the focus of the natural science discipline of biology involving 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 and Ukeh, 2017), is one of the science subjects offered throughout the senior secondary schools. It draws the most students who are interested in the arts and sciences. Most of the students choose Biology because it is considered as the easiest science subject when compared with Chemistry and Physics (Njoku 2015). The primary science discipline of biology focuses on the study of both plants and animals. Botany and zoology are the two main subfields of biology. The importance of Biology has been recognized in the development of drugs and vaccines for prevention and treatment

of diseases. Moreover, 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, Secondary school students in Nigeria have consistently performed poorly in biology (Nwafor 2014; Ihejiamaizu & Ochui, 2019). Aremu, and Oluwole (2002) stress that academic failure is not only frustrating to the students and parents. Its effect is equally felt in the society in terms of dearth of man power in all spheres of the economy.

There are various reasons for the relative underperformance in biology, these include the abstract nature of some biological concepts (Limer, 2012; Agboroma and Oyeovuli, 2015; Etobo and Fabinu, 2017; Lebata and Mudu, 2014), poor reading habits, an overloaded curriculum (Zeidan, 2010), and inadequate provision and utilisation 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. And this takes place when learning is coded into memory. Iwuji (2012). Thus, the appropriate coding of incoming 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 level of retention is influenced by the type of the materials to be coded. 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.

Models are teaching tools or resources, according to Yero (2010), that are used to show the teaching process and make education more real and thorough for the student. They are representations of an idea, object, event, process, or system. Models are very important teaching aids for science and biology. 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 tools or equipment, visual or aural representations, or examples that aid in learning. Yero (2010) categorized instructional materials into visual Aids, Auditory aids, and Audio-visual aids.

1. Visual aids: examples of these include a flip chart, a chalkboard, a bulletin board, displayed models, movies, slides, and more. In actuality, they stand in for all the teaching aids the instructor or teacher uses to impart the lesson to the students and on which the eyes can focus.
2. Auditory Aids, or tools that help with hearing, include record players, tape recorders, and language labs.
3. Audio-Visual Aids: These refer to assistive devices that combine sight and sound, such as sound movements, images, and 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.

To make teaching more concrete and thorough for the student, instructional models are teaching tools or resources that are used to depict the teaching process. Several instructional models have been successfully utilized to improve students' achievement in science. Gall (2005) affirmed that difficult and abstract concepts in Biology could be most appropriately taught when instructional models are fully utilized. Recent reviews support that instructional models have been used by researchers with positive and improved results. For example, Chatila and Hussein (2017) conducted research to investigate the effect of instructional models on students' achievement in Biology. The study employed a quasi-experimental design in which a sample of 120 students from two private schools in Beirut participated in the study. Where biology was taught to both the control group and experimental group. Pre and Post-test were administered to both groups for each school to compare students' achievement in Biology. T-tests statistics was applied to ascertain if the mean achievement differed significantly from one group to the next group based on pre-test and post-tests of the control and experimental groups in each school.

The study's findings demonstrated that instructional models significantly influence students' biology achievement.

In a same vein, Pandian (2004) examined how instructional models affected students' academic performance in biology in Langtang LGA, Plateau State. A sample of 120 students was used from a population of 3456 students. Results of the analysis using T-tests revealed that students who were taught digestive system concepts using instructional models performed better than their colleagues who were taught without instructional models. The research carried out by Jollite (2005) reported that effectiveness of instructional models for improving academic achievements. Similar results have been reported by Vaughan (2002) and Van (2010). Also, Osuafor et al. (2018) carried out a study on improving students' achievement in biology through effective utilization of instructional models in Awka south L.G.A of Anambra State. The study employed a quasi-experimental design, specifically the pre- test, non- equivalent control group design. A sample of 28 senior secondary school two (SS2) using biology students. The Biology Achievement Test (BAT) was the instrument used to collect the data. The reliability of the instrument was established using Kudder-Richardson formular to which yielded coefficient of internal consistency of 0.92. The data obtained was analyzed using mean and t-test. The results revealed that there was a significant difference between the mean achievement sure of students and those without using instructional paradigms to facilitate learning.

The effect of instructional models and students' academic success in biology was also examined by Ugwuadu and Abdullahi (2012). The study investigated the effect of instructional models on students' academic achievement in Biology in Unisex and mixed schools in Yola Adamawa state. The design of the study was quasi-experimental, non-equivalent central group design. The sample of the study consisted of two unisex (boys or girls) schools and six randomly selected mixed schools. 128 students each, from two intact classes in each of the two unisex schools randomly selected made up of 64 students from one intact class for experiment and another 64 students as central group. Biology achievement test which consisted of 40 multiple-choice objection test items was used for the study. To address the study issues, data were analyzed using mean and standard deviation, and the t-test was utilized to evaluate the hypothesis. The result of the study revealed that instructional models enhanced students' academic achievement in biology in both unisex and mixed schools. The achievement scores of the experimental and control groups were significantly different (P>0.05), favoring the experimental group.

**Purpose of the Study**

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

**Research Question**

This research question was generated to guide the study.

1. What is the effect of instructional models on Biology students' academic achievement in Biology (digestive system)?

**Methodology**

The study adopted a quasi- experimental, non-equivalent, non-randomized 2x2 factorial design. One treatment variable and one moderator variable make up the modified pretest-posttest. The factorial design was preferred because it allowed the assessment of the effect of each independent variable separately as well as their interaction effects (Onwioduokit, 2000). The experimental group was taught using instructional models while the control group was taught without instructional models. Both the experimental and control group were pre-tested, post-tested and given retention test after four weeks of posttest administration. The population of the study comprised all the SSII biology students in Ogoja education zone. At the time of the study, the zone comprised 2,825 senior secondary 2 (SS2) Biology students across 88 public secondary schools. (Cross River State Secondary Education Board Calabar (CRSSEBC), 2020). The population distribution is shown in Table 1.

**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 |
| Bekwara | 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)

The Biology Achievement Test (BAT) was an instrument developed for data collection.

## Results

**Research Question One:** What is the effect of instructional models on students' academic achievements in digestive system?

**Table 2: Mean and Standard Deviation of the Research Variables (n=127)**

| Group | Gender | Achievement | | | Retention | |
|---|---|---|---|---|---|---|
| | | N | $\bar{X}$ | SD | $\bar{X}$ | SD |
| With Instructional models | Male | 34 | 37.12 | 6.09 | 37.77 | 4.80 |
| | Female | 43 | 36.19 | 6.04 | 38.30 | 5.13 |
| | Total | 77 | 36.60 | 6.04 | 38.07 | 4.96 |
| Without Instructional models | Male | 26 | 20.35 | 2.53 | 19.69 | 2.07 |
| | Female | 24 | 20.75 | 3.39 | 19.25 | 1.65 |
| | Total | 50 | 20.54 | 2.95 | 19.48 | 1.88 |
| Total | Male | 60 | 29.85 | 9.68 | 29.93 | 9.81 |
| | Female | 67 | 30.66 | 9.10 | 31.48 | 10.12 |
| | Total | 127 | 30.28 | 9.35 | 30.75 | 9.97 |

The result as displayed in Table 2 indicated that the experimental group (instructional model) had a higher posttest mean score of 36.60 than the control group that had a mean of 20.54. The standard deviation was 6.04 and 2.95 respectively. The data in Table 2 shows that students taught digestive system using instructional models achieved significantly higher mean score compared to those taught without such models.

## Discussion of Findings

The result of the study revealed that students taught digestive system using instructional models achieved significantly higher mean score compared to those taught without such models. This finding agreed with that of Gabriel et al. (2018), who reported that there was a significant difference between the mean achievement scores of students and those taught without the use of instructional models. Similarly, Jollite (2005) reported the effectiveness of instructional models in improving academic achievements of students. Similar results have been reported by Vaughan (2002) and Van (2010).

## Conclusion

Based on the findings from the study, it is glaring that adequate provision and utilisation of instructional models is critical for the purpose of improving students' academic achievement and their retention of concepts in the digestive system. Instructional models positively influenced students' academic achievement of both male and female students. 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 teaching aid 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.

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