EFFECTS OF CONSTRUCTED MODEL OF HUMAN DUCTLESS GLAND ON ACADEMIC ACHIEVEMENT AND RETENTION OF STUDENTS OF BIOLOGY IN MINNA METROPOLIS: IMPLICATIONS FOR A DWINDLING ECONOMY IN NIGERIA

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Abstract

This study investigated the effects of constructed model of Human Ductless Gland on Academic Achievement and Retention of students of Biology in Minna Metropolis: Implications for a dwindling economy in Nigeria. The research design adopted for this study was pretest-posttest randomized control group design. Senior Secondary two(SSII) students in public secondary schools in Minna Metropolis were used for the study. Sixty students (60) participated in the study captured from two selected schools. The instrument used for data collection was a teacher made Biology Achievement Test (BAT).The questions were subjected to expert's assessment for face and content validity. To find out the reliability coefficient, test-retest method was used with an interval of two weeks and the scores collated and analyzed using PPMC and coefficient of r 0.85 was obtained. Four null hypotheses were formulated and tested at 0.05 level of significance. One of the findings of this study was that the use of constructed model facilitated student's achievement and retention in Biology. Based on the findings it was recommended that the government should organize seminars, workshops and conferences for teachers on the construction of models to enhance academic achievement and retention of students and also saving the monies spent on the importation of foreign models for teaching in Nigeria especially in this current dwindling economy.

Keywords: Model, Instructional Materials, Gland, Improvisation, Academic Achievement, Retention, Dwindling Economy.

Introduction

Science is an intellectual activity designed by humans to discover information about the natural world in which humans live to discover the ways in which this information can be organized into meaningful patterns[Taylor, 2008].Science is also a way of passing knowledge from one generation to another so our collective knowledge to solve problems related to our existence, happiness and productivity. Science makes us to find inquiry about living and non-living things, and also saves life. [Yildrim, 2008].

The goal of science is to advance human understanding of the universe we inhabit, it is not to achieve personal contentment, and science doesn't encourage violence but teaches fact and role of each individual in the universe. Science is very important because without science knowledge, man cannot discover the natural endowments and their importance.

Biology has been considered as a basic and natural science because it study's life and living organisms including their morphology, physiology, uses and the various methods used in approaching them. Biology is the science of life and of living organisms including their structure, function, growth, origin, evolution and distribution. Biological disciplines imply a significant responsibility for the protection and welfare of all living species. [Nsofor,2008]. It also investigates the environmental factors that surround the living beings and by means of conservation, it seeks for more effective ways to understand the immediate conditions of the environment that can threaten the existence of living organisms on our planets.

Instructional materials are educational resources used to improve student's knowledge, abilities and skills to monitor their assimilation of information and to contribute to the overall development and upbringing [Afolabi,2003]. Instructional materials may be reagents and apparatus for producing chemical and other reactions and for demonstrating and studying such reactions in the laboratory other examples are three-dimensional materials [such as globes, and experimental models], two-dimensional materials [charts, pictures, diagrams and drawings] and audio-visual materials like motion pictures, film clips, film strips, slide sequences, transparencies, records and tape recordings and radio and television broadcasts.

Instructional materials are highly important for teaching especially inexperienced teachers. Teachers depend on instructional materials for background information on the subject they are teaching teachers also need instructional materials to assess students' knowledge by assigning tasks, creating projects and administering examinations (Shem, 2011).

Among factors contributing to poor achievement of students in Biology are; use of inappropriate teaching techniques in Biology, principles on effective teaching are rooted in logic of instructional design, for example instructional methods Kumar (2005); Blurtit (2005) stated that unprepared teaching leads to haphazard presentation on the part of the teacher, lack of frequent regular assignments, tests and examinations with feedback to students, inadequate use of resources and facilities amongst others.

Blurtit [2005] defines achievement as a setting of a goal or the accomplishment of learning a difficult skill or improving your health and through hard work accomplishing the desired goals. Achievement is when you work hard to achieve and get to that goal in which most of the students in Biology are lacking. It is something successfully attained and it is based on persistence and dexterity. The ability of the students to retain knowledge and skills well after completing a topic is becoming increasingly relevant and focus on deep learning represents a priority for educational research in general. Given the awareness of deep learning and the relative death of long-term retention studies, a study on long-term retention in the Biological sciences is warranted. Nworgu (2005 stated that retention is an ability to recall or recognize what has been learned or experienced; memory. The key to have a retentive memory is to increase the ability to move our experiences from our short- term memory into long- term memory. Basically students' memory function is based on five laws and they are;

a) Association: tudents always remember events or experiences that are associated with other similar events and things more than activities that are not associated with anything.
b) Images: Students' memories are recorded as images; students learn to recall things much easier when they think in pictures or images.
c) Recency: Students' ability to recall any events continue to diminish over time because experiences that happened long back are not vivid to their mind in comparison to the events of the recent ones
d) Repetition: The more the students repeat or experience any memory, the better it is stored in their long- term memory for recalling.
e) Intensity: The more intense or vivid an experience is the more likely the students are to remember.

To improve the retention level of students in Biology, the students should be involved in information-decision making, problem-solving, investigation, policy analysis debate, critical thinking, creative thinking and information retrieval through the use of models or diagrams so as to enhance their performance in a dwindling economy.

A dwindling economy is seen as a situation in which the economy of the country does not support the teaming population. This results to inadequate infrastructural development, resources, social amenities, antisocial vices, economic recession and inflation amongst others. Some of the remedies to the economic recession are the utilization of locally manufactured products, reduction in the importation of goods and other products and the fight against corruption (Ibrahim, 2016).

The social and technological development of a country depends solely on science. Despite the fact that science plays this vital role, it is very disappointing that adequate teaching of Biology as a subject in our secondary schools is not improving leading to the poor performance in international examinations like West African Examination Council [WAEC] and National Examination Council [NECO].Findings by Osakwe [2003]; and Katie [2012] have shown poor performances of students in public examinations. West African Examination Council Examiners Reports (2008) revealed that student performance in

y in terms of drawings is discouraging.It is on these bases and the negligence of teachers towards provisation of instructional materials in teaching Biology that the research study is aimed at stigating the effects of constructed model of Human Ductless Gland on academic achievement and ntion of Biology students in secondary schools and its implications in a dwindling economy.

urpose of the Study

The purpose of the study is to find out the effects of constructed model of Human Ductless gland on;

(1) Students' academic achievement in Biology secondary schools.
(2) Determine gender influence on student's academic achievement.
(3) Students' academic retention in Biology in secondary schools.
(4) Find out gender influence on students' retention.

Research Questions

The following research questions were raised to guide the study;

(1) Would there be any difference between the mean achievement scores of students taught Biology with constructed model and those taught with convectional method
(2) Will there be any gender difference in the mean achievement scores of students' taught Biology with the constructed model
(3) Would there be any difference between the mean retention scores of students' taught Biology with constructed model and those taught with convectional method
(4) Is there any gender difference in the mean retention scores of students' taught Biology with constructed model

Research Hypotheses

Four null hypotheses were formulated and tested at 0.05 level of significance.

Ho_1: There is no significant difference between the mean achievement scores of students' taught Biology with constructed model and those taught with convectional method.

Ho_2: There is no significant difference between the mean achievement scores of male and female students' taught Biology with constructed model.

Ho_3: There is no significant difference between the mean retention scores of students' taught Biology with constructed model and those taught with convectional method.

Ho_4: There is no significant difference between the mean retention scores of male and female students' taught Biology with constructed model.

Methodology

Research Design

The research design adopted for this study is the Pretest-Posttest Randomized Control Group Design. This design is based on the assumption that subjects are randomized from the population under study.

Materials Used

The materials used for the construction of the model includes: plywood (1/4 thickness), modern frame, gum (evostic and glue), nail, polish (polygard neutral), computer, velvet, laminating leather, ruler and saw (fred and hand saw).

Procedures

The structure of human endocrine (ductless) gland was gotten from internet and carefully transferred to Corel draw package. After it has been transferred, it was then retraced in Corel draw package, filled with a brighter colour and later printed on A3 paper with the use of coloured DeskJet printer. After this is the joining of the work together, laminating, measurement of the print- out work on the plywood, gumming of the model on the plywood with the use of evostic gum, cutting, forming the base of the frame, placement of the velvet cloth on the surface of the base frame, mounting of the work and finally finishing.

Population of the Study

The total population of Senior Secondary two (S S II) students in Minna Metropolis was 4,400, in 2016/2017 academic year.

Sample and Sampling Techniques

The sample size used for the research study was (60) students which were randomly selected. Simple random sampling techniques was used in the selection of experimental group and control group in the two coeducational schools used (15 males and 15 females).

Instrumentation

The instrument used for data collection was developed progressively as the teaching was going on, and called Biology Achievement Test (BAT).The questions were drawn based on an approved table of specification on the six levels of cognitive domain. The questions were objective item type with four optional answers A-D with only one right answer. Twenty questions were drawn from the topic treated. Reframed twenty questions for retention test were also drawn. At each point in time in the administration of the instruments the questions were reshuffled to create an impression to the students as if different from the one used in the pretest and the posttest. See table below;

Validity of the Instrument

The instruments were validated by experts and experienced teachers in the field of Biology Education and educational Technology. The questions were also subjected to experts assessment for face and content validity by two Biology Educators, two Biology tutors in non- participating schools as they are the ones handling the subject at secondary school level and test and measurement experts from Niger State Ministry of Education, Minna.

Reliability of the Instrument

Pilot test was conducted in Government Secondary School Minna, which was not among the sampled schools used for the study. Ten students drawn randomly were given twenty item questions to answer from the Pretest and Posttest question; the scripts were collected and marked. After an interval of one week (Test-retest method), the same questions were administered to the students and the two scripts were collated and analyzed using Pearson Product Moment Correlation Coefficient alpha(PPMC) and r = 0.85 was obtained indicating that the test items were reliable and so used for data collection.

Method of Data Collection

Three different methods were used in the collection of data for the study. Pretest was used in the collection of data to determine the entry behaviuor of the students before the administration of the treatment. After this, posttest was used in the collection of data to answer the research hypotheses formulated at 0.05 alpha level of significance after the treatment. After one week of administration of the Posttest, retention test was administered to the same group of students to determine the retention scores of the students in both the experimental and control groups. At each point in the administration of posttest and retention test the questions were reshuffled to create an impression as if different from the one administered in the pretest.

Method of Data Analysis

The mean, standard deviation and t-test analysis were used to analyze pretest scores, posttest scores and retention scores using the Statistical Package for Social Science (SPSS) version 20.00.

Results

Table 1 Mean and Standard Deviation of Pretest Scores (Experimental and Control Groups

Variable	N	df	$\bar{x}$	SD	t-cal	Significant (2- tailed)	Remark
Experimental Group	30	58	4.73	2.55	0.414	0.681	NS
Control Group	30		4.47	2.45			

NS= Not significant at $p>0.05$

Table 1 shows the Mean and Standard Deviation of both the experimental and control groups. The mean score of the experimental group is 4.73 and SD= 2.55; df=58, while that of the control group is 4.47, SD= 2.45. The t-value calculated 0.414 while the P-value 0.681 is greater than p-value at 0.05 alpha level

Control
Group

S= significant at P<0.05

Table .2 shows the Mean, Standard Deviation of both the experimental and control groups. The mean score of the experimental group is 72.00, SD= 10.72; df=58, while that of the control group is 45.50, SD=9.22 respectively. The t-value calculated is 10.26 and the 2-tailed value is 0.000 which is less than p-value 0.05 this means that the null hypothesis one is rejected. That is, there is significant difference between the achievement scores of students' taught Biology with constructed model than those taught with conventional method.

HO_2: There is no significant different between the mean achievement scores of male and female students' in the experimental group taught Biology with constructed model.

Table 3 Mean, Standard Deviation and t-test Analysis of Male and Female in the Experimental Group.

Variable	N	df	$\bar{X}$	SD	t-cal	Sign(2- tailed)	Remark
Experimental Group	15		73.44	11.51			
		28			0.78	0.442	NS
Control Group	15		70.36	09.90			

NS= Not Significant at P>0.05

Table 3 shows the Mean, Standard Deviation of male and female in the experimental group. The mean score of the experimental group is 73.44, SD=11.51; df=28 and that of the control group is 70.36, SD=09.90. The t- value calculated is 0.78 and 2- tailed value is 0.442 which is greater than p-value at 0.05 alpha level. This means that the null hypothesis is retained. That is, there was no significant difference between the mean achievement scores of male and female students taught Biology with constructed model in the experimental group.

HO_3 There is no significant difference between the mean retention scores of students' taught Biology with constructed model and those taught with convectional method.

Table 4 Mean, Standard Deviation, and t-test Analysis of Retention Scores of Experimental and Control Group

Variable	N	df	$\bar{X}$	SD	t-cal	Sign (2- tailed)	Remark
Experimental Group	30	58	56.33	8.60	15.33	0.000	S
	30		27.17	8.15			

Table 4 shows the Mean and Standard Deviation of retention scores of both experimental and control group. The mean score of the experimental group is 56.33, SD=8.60; df=58 and that of the control group is 27.17, SD=8.15. The t- value calculated is15.33 and 2- tailed value is 0.000 which is less than p-value at 0.05 alpha level. This means that the null hypothesis is rejected. That is, there was significant difference between the mean retention scores of students' taught Biology with constructed model and those taught with convectional method.

HO_4: There is no significant difference between the mean retention scores of male and female students in the experimental group taught Biology with constructed model.

Table 5 Mean, Standard Deviation and t-test Analysis of Male and Female Retention Scores in the Experimental Group

Variable	N	df	$\bar{X}$	SD	t-cal	Sign(2-tailed)	Remark
Male	15		56.67	9.19			
		28			0.209	0.836	NS
Female	15		56.00	8.28			

NS= Not Significant at P>0.05

Table 5 shows the Mean and Standard Deviation of both Male and Female retention scores in the experimental group. The mean score of the experimental group is 56.67, SD=9.19; df=28 and that of the control group is 56.00, SD=8.28. The t- value calculated is 0.209 and 2- tailed value is 0.836 which is less than p-value at 0.05 alpha level. This means that the null hypothesis is rejected. That is, there was significant difference between the mean retention scores of male and female students' taught Biology with constructed model.

Discussion of Results

The findings of this study are in agreement to the findings of; Nworgu (2005); London (2005); Okwo, et al (2007); Nwachukuwu and Nwosu (2007) who noted that the experimental group did better than the control group when diagrams, graphics, and charts were used in teaching in senior secondary schools and that their uses enhanced the academic achievement of students. Also there was a significant difference between the mean achievement scores of students taught Biology with constructed model and those taught with conventional method. This was because the visual characteristics of the model and its manipulation enhanced the achievement of the students than their counterparts taught with convectional method.

Table 1 revealed that the male and female in experimental group did not show any significant difference between the mean achievement scores, therefore the null hypothesis two (Ho_2) stating no significant difference in the mean achievement scores of male and female students' in the experiment group taught Biology with constructed model was retained. This is corroborated by the finding of Okwo and Iliya (2004) who noted that gender do not any influence on academic achievement of students when exposed to the use of diagrams in learning Biology and Geography in secondary schools.

Table 2 revealed that there was a significant difference between the mean retention scores of students taught Biology with constructed model and those taught by convectional method. Hence the null hypothesis three (Ho3) was rejected. In support of thisNworgu (2005) noted that there was no significant difference retention when both groups were exposed to graphic or advanced organizers. Similarly, the finding is corroborated by that of Sobamowo (2006) and Gimba (2006) who established that there was no significant difference between experimental group and control group.

Table 3 showed that there was no significant difference between the mean retention scores of male and female in the experimental group taught Biology with constructed model. Hence the null hypothesis four (Ho_4) was retained.This finding is in agreement to the findings of;; Ayodele (2001); Cirfat (2006); Dawudu (2007) who found out that there was no significant difference between male and female students exposed to Physics, Mathematics and Biology using diagrams, models and graphics.

ive and efficient use of constructed models facilitates students' academic achievement and . The evidence in experimental group shows that the use of models make teaching and learning plicit and serves as a guide to understanding of some concepts leading to better achievements and on of concepts in Biology. It was also established that the use of models does not exert any ence in academic achievement and retention among gender in Biology.

commendations

view of the findings, the researcher recommends the following;

(1) Teachers should be encouraged to study educational technology where they can learn the design and construction of instructional materials.

(2) Seminars, conferences and workshops should be organized for teachers on the usefulness of diagrams and models in the course of instruction.

(3) Experience practicing Biology teachers should be allowed to participate in the ordering of science apparatus.

(4) There should be reinforcement of dedicated teachers through price giving.

Implications for a Dwindling Economy

The followings are some of the implication of the use of constructed models locally for use in a dwindling economy;

1. Government, educational administrators, stakeholders and principals of various schools should support and encourage the creativity of co-science teachers by providing some incentives for the production of locally sourced teaching materials which will reduce importation of foreign science and technology equipment in Nigeria.
2. High tax should be charged on companies, industries, business men and other groups on the importation of foreign instructional media for teaching and learning, this will reduce over dependence on imported media and thus increasing the internally generated revenue for the country.
3. The study of Fine Arts that used to be the cardinal exercise in primary schools in 1960s should be resuscitated so that teaching materials could be produced locally for use in school thus saving the nation from the huge expenditure on foreign equipment procurement.

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