

EFFECT OF INTEGRATED MODEL OF TEACHING ON STUDENTS RETENTION IN BIOLOGY

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Abstract

The inability of Nigerian students to retain scientific knowledge/store information in mind worries the stakeholders in teaching and learning process and general public, attributing to teachers' method and manner of imparting the knowledge among other factors. This study was, therefore, designed to investigate the effect of Integrated Model of Teaching on retention of Students' in biology. The study was guided by two research questions and three null hypotheses. A quasi experimental non-equivalent control group design was used. 351 SS II biology students were drawn from a population of 1406 SSII Students of four selected schools in the study area. Multi-stage, stratified random sampling technique were used. Data Collection was made using Biology Teacher Made Retention Test (BTMRT). Reliability coefficient of 0.72 was established with Kuder Richardson formula 20 (K-R20). Mean (\bar{x}) and standard deviation(s) were used to answer research questions while analysis of covariance was used to test hypotheses at 0.05 probability level.

Introduction

In this era of Science and Technological growth and development, many countries of world are struggling for science and Technological advancement. Nigeria is not left out of this race, that she has reflected this in her National Policy on Education FME (2004), where she made the study of sciences compulsory at all levels of Education. Nigeria has equally, some time now, pegged admission policy into her Polytechnics and Universities in Science and Technology programmes at 70% and 60% respectively. According to Fafuwa in Aniodoh (2004). "In the world of today, Science and technology have become dominant cultural factors any nation that is not alive to this fact is either dead or dying". His view is that man requires knowing and practicing enough science and technology for self-survival, preservation, independent and development.

Good science teaching and technological advancement is however, based on the sound science education programme rooted in physics chemistry and biology, where foundation is laid in secondary schools. Unfortunately, the retention of students' in science courses had remained poor for some decades. This affects their performance in the subjects in secondary schools levels as replied in literature Eze, (2002), Mbajirogu, (2002), WAEC, (2004) and Ogbu, (2005). One of the possible causes of Nigerian student's poor retention in sciences is inability of mastering scientific concepts Adeyegbe (1993). Research in education on the quality of teaching and learning process is becoming increase

because of its place in instructional delivery (Schiefele, Klaus-Peter and Krapp (1995), in Enugu (2007).

Therefore, to search for teaching method that can ensure students high understanding and retention of Science concepts is highly motivated, since conventional method have failed to help science student retain science concepts and facts. Hence, the move to search for intervention/innovative method of instruction-Integrated model of teaching. However, the common method of instruction applied by teachers in secondary schools in Nigeria is Lecture method which involves verbal presentation of subject matter/content. According to Aniodoh (2004) in Eze and Egbo, (2007), lecture method as conventional method, is didactic, stereotype and non-result oriented. It is often described as “talk and chalk” method because its presents information to the students who merely listen.

Integrated Model of teaching is an innovative instructional model which entails the combination of theory and practical activities at the same period of teaching and learning process. It can be described as teacher student centered instructional model since both participate actively in the teaching and learning process. According to Akubuilu, (2005), teaching is no longer restricted to teachers as encyclopedia of knowledge though it is a known fact that teachers play important role in any curriculum implementation. In using the model, the teacher teaches by integrating theory and practical activities. The model can go along way to enhance students’ retention ability in the subject.

Studies carried out so far in science on some innovative methods such as concept mapping Egbo, (2005), cooperative learning and concept mapping, Anidu, (2007), and Analog Model, Ugwu, (2007), revealed their efficacy in enhancing the students retention of biology concepts. Would the present study show the same trend? Some other studies also in retention focus on comparing gender retentive ability in science. Thus while some pointed out that male show more retentive ability, some revealed that female retain better than male. Which of this trend would the present study reveal? A major question therefore arises as to what will be the effect of Integrated Model of teaching on the retention of students in biology?

Research Question

1. What effects does the use of Integrated Model of Teaching (IMT) and Separatist Model of Teaching (SMT), have on SS II Students’ retention in biology?
2. How does the mean (\bar{x}) retention scores of male students’ taught some biology topics compare with the mean (\bar{x}) retention score of them female counterparts in BTMRT?

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Hypotheses

- Ho₁: The mean retention scores of SS II student who were taught some biology topics using IMT and SMT would not differ significantly ($P < 0.05$).
- Ho₂: The mean (\bar{x}) retention scores of SS II male and female students who were taught some biology topics with IMT and SMT would not differ significantly ($P < 0.05$).
- Ho₃: The interaction effect of instructional method and gender on biology retention will not be significant ($P < 0.05$).

Method

Quasi experimental, pre-test post-test, non-equivalent control group research design was adopted in the study; which was carried out in Enugu East Local Government Area of Enugu Education Zone. There are nine School Secondary Schools in the Local Government Area with a total of one thousand, four hundred and six (1406) SSII biology students; that comprised the population for the study. A sample size 351 students were drawn from the population using multi-stage sampling technique, involving purposive, stratified random sampling techniques. Eight in-tact classes from four sampled (selected) schools were used.

Instrument for data collection was a biology teacher made retention test (BTMRT) developed by the researcher. It consists of fifty multiple choice retention test items and was validated by five experts in biology education.

Reliability of the instrument was established using Kuder Richardson fomular 20(K-R20), at the end of which a reliability index of 0.72 was obtained. The instrument was administered by the help of research assistance. First the pre-test, then post-test after treatment and two weeks later, the retention test to both IMT and SMT groups. Research questions were answered using mean and standard deviation while null hypothesis were tested using multiple classification analysis of covariance

The decision rule was that any variable with mean score of 25 ($\bar{x} =$ or $> 50\%$) was interpreted as high and any mean below 25 or $\bar{x} < 50\%$ was regarded as low. For null hypotheses, if F-cal value was less than f-cv ($F\text{-cal} < f\text{-cv}$) at 0.05 level of significance, the null hypothesis is not rejected ie; upheld whereas it was not held (rejected) if $F\text{-cal} > F\text{-cv}$ at 0.05 level of significance.

Presentation of Results

The results of this work are presented in the table below in relations to the research questions and null hypotheses.

Research Question One

What effects do the use of Integrated Model of Teaching (IMT) and Separatist Model of Teaching (SMT) have on SSII retention?

Table 1: Mean (x) retention score and standard deviation of the two groups. N= 351.

Group	Tests	Mean	Standard deviations	Cases
Experimental	Retention	57.10	9.28	176
Control	Retention	44.87	7.05	176

The result in table 1 above revealed that experimental and control group obtained means (x) retention scores of 57.10 and 44.87 respectively. The result further showed that the IMT group differ from SMT groups in the mean (x) retention by 12.23, indicating that the IMT group (experimental) retained better than the SMT (control).

Research Question Two

How does the mean (x) retention score of male students' taught some biology topics compare with their female counterpart in BTMRT.

Table 2: Mean (x) retention score obtained by male and female students in some biology topics N= 351.

Gender	Tests	Means	Standard deviations	Cases
Male	Post-BTMAT	51.71	10.29	171
	BTMRT	49.46	10.69	171
Female	Post BTMAT	54.88	9.10	180
	BTMRT	52.46	9.63	180

Table 2, above reveals that male and female students obtained a mean (x) retention scores of 49.46 and 52.46 respectively and a standard deviation of 10.69 and 9.63 respectively. The table equally, shows that the two mean (x) retention scores differ by three (3) marks in favour of female, an indication that female retain higher than male. However, such difference of 3 marks in minimal may be as a result of chance error.

Null Hypotheses

- Ho₁: The mean (x) retention score of SSII students who were taught some biology topics with IMT and SMT would not differ significantly (P< 0.05).
- Ho₂: The mean (x) retention scores of SSII male and female students who were taught some biology topics using IMT and SMT would not differ significantly (P< 0.05).
- Ho₃: The interaction effect of instructional method and gender on biology retention will not be significant (P< 0.05).

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Table 3: Analysis of covariance (ANCOVA) showing the main and 2-way interaction effects of instructional method and gender on students Retention in biology. N = 351.

Source of Variation	Sum of Square	Df	Mean Square	F-cal.	F-Cv significance	Decision Rule
Covariates	20955.11	1	20955.11	3746.68	0.000	S ^{xx}
Post BTMRT	20955.11	1	20955.11	3746.68	0.000	S ^{xx}
Main Effects	559.99	2	279.99	50.06	0.000	S ^{xx}
Gender	.275	1	.28	.05	0.825	NS ^{xx}
Groups/Method	556.58	1	556.58	99.51	0.000	S ^{xx}
2-way Interaction	2.65	1	2.65	.47	0.492	NS ^{xx}
Gender method	2.65	1	2.65	.47	0.492	NS ^{xx}
Explained	34888.83	4	8722.21	1559.49	0.000	S
Residual	1935.17	346	5.59			
Total	36824.00	351	105.21			

S^{xx} = Significant at P < 0.05

NS^x = Not significant at P > 0.05

For hypothesis 1, table 3 shows that the calculated F-ratio (F-cal) due to instructional method is 99.51 while from the f-statistics table, the critical value (F-cv) at 0.05 probability level (1 and 346) degree of freedom is 0.000. F-cal (99.51) is thus greater than F-cv (0.000) at alpha level of 0.05. The decision is to reject the null hypothesis if the F-cal value exceed the F-cv value at a given probability level. The null hypothesis is thus rejected showing that students' mean (x) retention scores depend on instructional method. This means that Integrated Model of Teaching enhances retention in biology.

In the case of hypothesis II table 3 reveals that F-cal due to gender is 0.049 where as the F-cv from F-statistics table, at 0.05 probability level (1 and 346) degree of freedom is 0.83. F-cal 0.49 is less than that F-cv which is 0.83 at 0.05 level of significant. Since F-cal is less than F-cv (0.049 and 0.83) respectively, the null hypothesis II is rather upheld, indicating that there is no significant difference in the mean (x) retention test scores of male and female students in biology or that gender has no effect on retention of students in biology. For hypothesis III, table 3 shows that F-cal and F-cv on the two (2)-way interaction effect of gender and instructional method are equally 0.47 and 0.49 respectively. F-cal (0.47) is also less than F-cv (0.49) the interaction between teaching method and gender on the students mean (x) retention in biology is upheld.

Summary of Findings

The major findings of the study were as follows:-

1. That students' retention in biology seem to depend on the instructional method.
2. That IMT group obtained higher retention scores than the SMT group.
3. That gender is not a factor on the retention of students in biology.
4. That instructional method and gender have joint effect on students' retention in biology.

Discussion of the Findings

In the case of the issue in research question one, the finding reveals that instructional method has a significant main effect on the retention of students in biology. This finding supports what was earlier said by Ndukwe (1995) and Mbajiorgu (1995), that teachers' instructional method can greatly affect students' retention in biology. This is because the experimental groups were provided with opportunities to employ all their series in the learning process through practical activities, which enable them to retain more facts and concepts since retention implies remembering or ability to store information/knowledge for a long time. To support the above, Obodo (1997) and Ureubu (1990) pointed out that poor learning and retention of science concepts may be related to inability of the students to link present learning with the previous knowledge. Supported this are Maduabum (1995) in Ugwu (2007) as well as Anidu (2007) who poised that students learnt best and retain most when the subject matter has meaning to them and when gives opportunity to interact with learning materials as provided by integrated model of teaching.

However, the two- way interaction effect of gender and method, as well as gender are do not affect students' retention; though source of variance, main effect and method are significant the retention of facts in science. Thus study finally indicated that retention in science (biology) depends on the instructional model/method but independent on the gender of individuals concerned.

The relative superiority of IMT over the SMT in enhancing students' retention could be attributed to the fact that as instructional model, IMT ensures active participation of students in the teaching and learning process. SMT Model often subjects student to the position of a passive recipients of facts handed down to them by the teacher. Therefore given this prevailing circumstances under which the two instructional models (experimental and control) are employed, it is not surprising that the experimental group retain better/more than the control groups in BTMRT.

Conclusion

From the results obtained in this study, it is concluded that IMT enhances more understanding and comprehension of biology concepts, principles and science process skill acquisition. The researcher therefore advocates for its use.

Recommendations

The following recommendations are made, in view of the finding of the study:-

1. Government agencies and professional association who are in charge of designing and revising the curriculum for secondary schools should include and emphasize the use of IMT in teaching biology and other sciences.
2. Workshops and seminars should be organized by relevant professional bodies and government agencies to help educate teachers on the use of IMT in teaching and learning science subjects due to its relative newness to teachers and its efficacy in fostering learning.
3. Professional bodies like Science Teaching Association of Nigeria (STAN) examination bodies such as West African Examination Council (WAEC) and National Examination Council (NECO) should help to sponsor further research on the efficacy of IMT in promoting retention among the students in Nigerian secondary schools.

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