EFFECT OF COMPUTER-BASED INSTRUCTION (CBI) ON STUDENTS' RETENTION IN BIOLOGY IN OLAMABORO, KOGI STATE, NIGERIA

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Abstract

The study determined the effects of computer-based instruction (CBI) on students' retention in biology in secondary schools in Olamaboro Local Government Area(LGA) of Kogi State. Pre-test, post-test quasi-experimental design was adopted. The sample comprised 224 students (127 males and 97 females). Simple random sampling was used to assign intact class to experimental and control groups, while purposive sampling was used to select secondary schools that have computers in Olamaboro LGA of Kogi State. Biology Achievement Test (BAT) with reliability Coefficient of 0.71 was used to collect data. The research questions were answered by the use of mean and standard deviation while hypotheses were tested at 0.05 significant level using Analysis of Covariance (ANCOVA). The result showed that significant difference exists ($F_{1, 223}$ =169.59, P=0.0001<0.05)between students taught using CBI and those taught using conventional method in favour of those taught with CBI. However, there was no significant difference in the mean retention scores between male and female students taught using CBI ($F_{1, 124}$ = 1.431 at P=0.234 >0.05 for retention). Based on the findings, it was recommended that relevant computer based instruction packages should be developed and distributed to secondary schools as well as encouraging secondary school teachers to adopt CBI strategy in teaching of biology.

Keywords: Computer Based Instruction (CBI), biology, retention, teaching biology, secondary school

Introduction

Biology as one of the science subjects offered in senior secondary schools deals with the scientific study of living things, their relationship with one another and with the natural environment among other things. It is important to note that biology curriculum offered in secondary schools has the objectives of preparing the students to acquire adequate laboratory and field skills in biology; acquire meaningful and relevant knowledge in biology; acquire ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; and acquire reasonable and functional scientific attitude (FME, 2009).This implies that there is a need to train individuals particularly in biology who would possess the qualities as spelt out in the biology curriculum especially, scientific personnel. Onwu (2007) puts it that we have an obligation to help students become critical thinkers and problem solvers. This is only attainable when appropriate teaching and learning strategies are adopted particularly at the secondary school levels.

For a student to achieve well in examination ability to recall what was learnt is a necessary condition. Further, one can only recall what is retained. Therefore, retention which is the ability to remember things learned by individuals at later time is necessary for better achievement. Retention takes place when learning is coded into memory, and appropriate coding of incoming information provides the index that may be consulted hence enabling retention to take place without an elaborate search in the memory lane (Oyedokun, 1998).

Bichi (2001) reports that anything that aids learning improves retention while things that lead to confusion or interference among learned materials decrease the speed of and efficiency of learning

and accelerate forgetting. It can be asserted that the poor or low achievement in biology by secondary school students is due to poor retention. Using computer-based instruction to teach students may help in solving learning problems in biology encountered by secondary school students, by increasing their motivation, achievements and hence retention. Senemoglu (2003) identified that CBI is more effective on less successful children as it enables the children to progress at their own pace and provides them with appropriate alternative ways of learning by individualizing the learning process. The works of Ikpe (2011) and Ukwuru (2012) buttressed this fact. This implies that CBI has records of facilitating learning in integrated science and chemistry. There is also need to try it in biology being a life science.

This research work examined the effects of CBI on students' retention and also found out if differences in retention exist due to gender. This is because certain factors such as gender could affect students' retention in biology. Omale (2012) reported that boys were superior to girls in school achievement in biology but Ajaja and Eravwoke (2010) found that there was no significant difference in retention of male and female students when cooperative method was used. It must be noted here that cooperative method is not the same as CBI though both are highly interactive. Most times, it is a believe without empirical support that because men are regarded as dominant and even superior sex, they intrinsically have better brains and learn much better than women (Mkpugh in Ikpe, 2011). This requires empirical evidence. Onwuebguna (2009) found that there was no significant difference in the achievement of male and female students when computer assisted instruction was used. Though the work was on achievement rather than retention, it could be a pointer to the expected result in the present study.

It is clear from the review that the use of CBI was more common with chemistry, physics and integrated science to the neglect of biology which is life science. Because of the nature of the subject it is costly to assume that the same result applies to biology without applying it. This work is therefore interested in the effect of CBI on retention of male and female students in biology in Olamaboro L.G.A of Kogi state.

Statement of Problem
The main goal of teaching and learning is to bring about the desired behavioral change in learner. Given the high value placed on biology in the Nigerian secondary school curriculum, the need to teach it effectively through an effective method is indispensable.

Many reasons have been advanced for the poor retention of learning materials by students. For instance, students' poor understanding of the basic concepts in biology, use of inappropriate method of teaching by biology teachers and students (Okebukola, 2005; Orokpo, 2006) were found to influence students' retention in science. Equally, it is possible that students' inability to retain what was learnt for some time could be responsible for low achievement in biology because the traditional method of teaching predominantly adopted by biology teachers in the study area as observed by the researchers does not encourage good retention. For instance, Biodun (2002) identified that the use of student centered approach to teaching and learning enhances achievement and consequently high retention in school subjects. Observation over the years and as reported by WAEC chief examiners (2006, 2008 and 2010) reveal poor performance which as strong link to poor retention. The probable assumption is that all interactive learning/teaching methods have not been tested. The pertinent question which arises is, could computer-based instruction which is an interactive strategy enhance retention in biology? In view of this background, the problem of this study posed as a question is, what is the effect of CBI on students' retention in biology among secondary school students in Olamaboro Local Government Area?

Research Questions
The following research questions were answered in this study:

(i)   Do students taught biology using CBI differ in their mean retention compared with those taught using conventional method?

(ii)   Is there a difference in the mean retention of male and female students exposed to CBI in biology?

Hypotheses

The following null-hypotheses were tested at 0.05 significant level.

H_{01} There is no significant difference in the mean retention scores of students taught biology using CBI and those taught using conventional method.

H_{02} Male and female students do not differ significantly in their mean retention scores when they are expose to CBI in biology.

Methodology

A quasi-experimental pre-test and post-test research design was used for this study. The choice of this design was because of the nature of the subjects which do not lean themselves to complete randomization process, hence, intact classes were randomly assigned to the groups and generalization was made. The students' achievement and retention were considered as dependent variables while the conventional and computer-based instruction modes of teaching were independent variables whose changes may affect the achievement and retention in biology.

This study was carried out in Olamaboro Local Government Area of Kogi state Nigeria. The state is one of the states in the North-Central geo-political zones of Nigeria. The population of this study was one thousand, seven hundred and twenty-two (1,722) Senior Secondary School two (SSS 2) students in 21 secondary schools in the area. The schools were made up of fourteen (14) government owned and seven (7) private owned schools. Only the public schools were considered in the study. All the students in the senior secondary schools in the area offer biology. Selecting of topics needed to be covered at the time of visit made it easy for the researchers to be granted permission by the school authority. Since the school time table was followed strictly, the students saw the exercise as normal classroom activity.

Purposive sampling was used to select schools by visiting all the secondary schools to identify those with computers; hence, four schools were identified for use. All the schools have male and female students which take care of gender as a variable under consideration. Two hundred and twenty-four (224) senior secondary school two (SSS 2) students were drawn from four (4) public schools in Olamaboro Local Government Area of Kogi State. Simple random sampling was used (by hat and draw) to assign intact classes to experimental and control groups. Any school that was assigned to a group automatically had the students fall under such treatment

Biology Achievement Test (BAT) was used to collect data for the study. The instrument was prepared by the researchers comprising of forty multiple choice items initially and reduced to 30 after validation. Each item has 4 options A to D. The questions which were of West African school Certificate Examination (WASCE) standard were drawn from basic concept and transport and tissue systems using table of specification.

Training was conducted for the qualified teachers with B.Sc (Ed) Biology who have had 5-years and above of teaching experience for the period of four days on the use of computer-based instruction packages and lesson plans for the treatment groups. The training was carried out through micro-teaching whereby the teachers were allowed to teach with the instrument. This was to ensure homogeneity of instructional situation on the groups as much as possible.

Face and content validity of the instrument (BAT) prepared by the researchers were carried out by a chief lecturer and two senior lecturers. The researcher sought the advice of the persons who

validated the instrument, especially on the suitability, content and item construction, language used and correct options. Their observations and suggestions for corrections particularly on removal of some of the test questions identified not necessary and modification of some others reduced the items from forty to thirty.

The 30 items were used in trial testing. From trial testing, the scores gathered were used by the researcher to calculate the reliability of the instrument using Pearson Product Moment Correlation Coefficient method. This yielded an r value of 0.71, a coefficient considered to be reliable and having a good internal consistency.

The two groups (experimental and the control groups) were subjected to Biology achievement Test (BAT) as pre-test in which the scores were collated. The students in the experimental group (CBI) were exposed to CBI packages in the form of lesson plans installed on desktop computers. Those students in the CBI were introduced to CBI format under teachers' supervision long enough for them to be familiar with the use of computer, and use the packages independently. They were also urged to take note which could be useful. Diagrams and illustrations stored in the system were at students' disposal. For every topic mentioned for teaching, the students open the file, and following the instruction, they able to read, label, describe, draw and answer questions. Individual learning was preferred though each student can on the teacher anytime for clarification or assistance. It was an interactive session.

The control group students were exposed to the conventional teaching method using lesson plans on the same contents used for experimental group (CBI) strategy. The use of lecture along side with demonstration featured prominently in the lessons.The treatment for all the groups lasted for six weeks. After the treatment, the two groups were exposed to BAT after being reshuffled as post-test. Four weeks after the post test, retention test (that is, delayed post test) was administered.

Results
Mean and standard deviation were used to analyze the research questions. The hypotheses were tested using Analysis of Covariance (ANCOVA). ANCOVA was used to compare the means of two groups investigated through experimental design procedure since it could take care of their initial difference (i.e. problem arising from use of intact class).

Research Question1
Do students taught biology using CBI differ in their mean retention compared with those taught using conventional method?

Table 1: Mean and Standard deviation for pre and retention tests of students in the two groups

Method		Pre-test	Retention	Mean Gain	Mean Difference
CBI	Mean	35.40	54.74	19.34	
	N	125	125		
	Std. deviation	7.77	7.49		8.59
Con. Strategy	Mean	27.07	37.82	10.75	
	N	99	99		
	Std. deviation	8.81	7.70		

Table 1 shows that the mean retention scores of students taught with CBI is higher than those of students taught with conventional strategy with mean gain of 19.34 and 10.75 respectively. The

mean gain difference in the retention scores between the CBI and conventional strategy is 8.59 in favour of those taught using CBI strategy.

Research Question 2
Is there a difference in the mean retention scores of male and female students exposed to CBI in biology?

Table 2: Mean and Standard deviation of male and female students' mean score in
experimental group

Sex		Pre-test	Retention	Mean Gain	Mean Difference
Male	Mean	35.37	55.44	20.07	
	N	68	68		
	Std. deviation	8.30	8.39		1.60
Female	Mean	35.44	53.91	18.47	
	N	57	57		
	Std. deviation	7.15	6.22		

Table 2 shows that the mean retention gain scores of male students in the CBI method (20.07) are higher than that of female (18.47). The difference in the mean retention gains between male and female students is 1.60 and it's in favour of the male students.

Hypothesis 1
There is no significant difference in the mean retention scores of students taught biology using CBI and those taught using conventional method.

Table 3: ANCOVA for students' retention in experimental and control groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	17497.041[a]	4	4374.260	86.378	.000	S
Intercept	18811.568	1	18811.568	371.468	.000	S
Pre-test	1595.984	1	1595.984	31.516	.000	S
Method	8588.084	1	8588.084	169.587	.000	S
Sex	18.828	1	18.828	.372	.543	NS
Method * Sex	49.777	1	49.777	.983	.323	NS
Error	11090.419	219	50.641			
Total	528965.000	224				
Corrected Total	28587.460	223				

a. R Squared=.612 (Adjusted R Squared = .605); S = Significant; NS = Not Significant

Result in Table 3 reveals that significant difference exists between mean retention scores of students taught with CBI and those taught with conventional strategy. From the Table, $F_{1, 223} = 169.59$, $P = 0.0001 < 0.05$ which implies that the difference is significant. Null hypothesis one is therefore rejected.

Hypothesis 2
Male and female students do not differ significantly in their mean retention scores when they are exposed to CBI in biology.

Table 4: ANCOVA for experimental group male and female students' retention

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	618.630[a]	2	309.315	5.955	.003	S
Intercept	11586.489	1	11586.489	223.057	.000	S
Pre-test	546.148	1	546.148	10.514	.002	S
Sex	74.310	1	74.310	1.431	.234	NS
Error	6337.178	122	51.944			
Total	381569.000	125				
Corrected Total	6955.808	124				

a. R Squared=089 (Adjusted R Squared = .074); S = Significant; NS = Not Significant

Result in Table 4 indicates that the calculated $F_{1, 124}$ = 1.431 at P=0.234 >0.05 which indicates that the difference is not significant hence the null hypothesis 2 is accepted. This shows that the male and female students do not differ significantly in their mean retention scores when they are exposed to CBI strategy in biology.

Discussion of Findings
From the results of the analysis shown in the Tables 1and 3 it is observed that students taught tissues and supporting systems using CBI strategy retained significantly higher than those taught using conventional strategy ($F_{1, 223}$ =169.59, P=0.0001<0.05). The fact that CBI encourages students' greater involvement in the class activities through their senses (sight and movement at their pace with the computer) in a step-by-step-wise activity could make it more interesting to students. Perhaps, this makes the concepts more concrete rather than being abstract compared to when students are taught using conventional method. This finding conforms to the earlier findings of Ikpe (2011and Ukwuru (2012) which all support the fact that CBI enhances students' retention in subjects than the conventional method.

The result of the analysis of covariance (ANCOVA) showed that there is no significant difference in the mean retention scores of male and female students exposed to CBI in biology. This finding is in agreement with the earlier findings of Ukwuru, (2012) who asserted that there is no significant difference in the mean retention scores between male and female students taught using CBI. Ajaja and Eravwoke (2010) had similar result when cooperative method was used. This implies that the use of CBI strategy enhances the retention of both male and female students in biology. Therefore if a teaching strategy is interactive, stimulating and student centered, it is likely not to discriminate across sex as found in this study.

Conclusion
The use of CBI teaching biology enhanced retention among secondary school biology students. Also there is no gender difference in retention among students when taught using CBI and so CBI is relevant for teaching of biology in secondary schools.

Recommendations
Based on the findings in this study, the following recommendations are advanced:
(i)   Biology teachers should be encouraged to use CBI as one of the techniques for teaching at the secondary school level.
(ii)   There is need for production and distribution of education software to secondary schools by relevant agencies to ensure that relevant materials required for use of CBI in biology classrooms are provided.

(iii)   There is need for incorporation of CBI into the curriculum of biology education in Nigeria secondary schools. By so doing there would be a steady and planned way of effective introduction and use of CBI to teach biology.

(iv)   It is recommended that stakeholders in education (curriculum planners) should integrate a practical computer application course for pre-service teachers. This will possibly empower them to be able to deliver computer related services at the secondary school level.

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