

# **EFFECTS OF COMPUTER-BASED BLENDED LEARNING STRATEGY ON SECONDARY SCHOOL CHEMISTRY STUDENTS' RETENTION IN INDIVIDUALISED AND COLLABORATIVE LEARNING SETTINGS IN MINNA, NIGER STATE, NIGERIA**

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**Abstract.** This study investigated effects of Computer-based blended learning strategy on Secondary School Chemistry students' retention in individualised and collaborative learning settings in Minna, Niger State, Nigeria. The study adopted a quazi-experimental design and three research questions and three null hypotheses were formulated to guide the study. Multi-staged sampling procedure was used to select a total of 120 (71 female & 49 male) students from three co-educational schools within the study area. The selected students were randomly assigned to experimental group I (Computer-based blended learning in individualised setting) experimental group II (Computer-based blended learning in collaborative setting) and the control group (lecture method). A multiple-choice question items on Chemistry that was developed, validated by the Chemistry experts was pilot-tested and a reliability coefficient of 0.74 was obtained using test re-test method. The achievement test was administered as instrument for data collection to students as pre-test, post-test and retention test.

The data obtained from the administration of research instruments were analysed using Analysis of Covariance (ANCOVA) statistics. The results indicated that Computer-Based Blended learning strategy improved students' retention in chemistry in collaborative learning settings better than in individualized learning setting and in lecture method. It was therefore recommended among others that students should be exposed to Computer-based blended learning strategy in collaborative learning setting in order to aid their retention of chemistry concepts.

*Keywords:* computer-based package, blended learning, collaborative setting, individualised setting, retention

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### **Introduction**

The 21st century is characterized by a technology-infused environment with a budding generation of digitally conscious youths that are highly conversant with various forms of electronic gadgets and tools from the Information and Communication Technology (ICT) sector, such as personal computers (laptops, etc.), cellular or smart phones, digital (satellite) television channels and other emerging electronic media that allow people and organisations to communicate and share information digitally.

Perhaps, there is a widespread trend in the industrialized world and a fast growing tendency in the developing nations, Nigeria inclusive. Therefore, it has become paramount to address the challenges and expectations of the 21st century learners and provide them with alternative and new learning opportunities capable of responding to theirs and teachers growing interest in technology-based learning experiences. For instance, the application of computer technology in classroom environment has shown to play significant role in enhancing teaching and learning of science subjects (Falode & Onasanya, 2015).

In Nigeria, Chemistry is one of the important science subjects taught at the Senior Secondary School (SSS) level. It is one of the core science subjects that students are required to pass at credit level in order to qualify for admission into tertiary institutions to pursue science-based programmes. In spite of this central and important position of chemistry among others science and related disciplines, studies revealed that, academic achievement of students in chemistry at Senior Secondary School Certificate Examination (SSSCE) has consistently been very poor and unimpressive (Njoku, 2007).

Retention is the ability to hold information or store learned material for future use learning. The prevalent problem in secondary schools is poor retention among secondary students offering science subjects including Chemistry. Concepts learned tends to fade with time, when what is learnt is not retained, hence, lead to forgetting which normal day event is. Without making reference to recalling and putting to positive use what has being previously learnt and retained may quickly lost. Retention has also been seriously observed as challenges that discourage students from learning science subjects such as chemistry.

Computer-based instructional applications are considered an effective alternative to traditional teaching methods and today in numerous educational and training settings, interactive computer programs are used to teach young students and adult's computer literacy skills. Computer based instructional modules provide great promise for handling functions like testing, diagnosing student deficiencies, student progress and providing individual schedules and study assignment (Varank, 2006)

Empirical studies of studies carried out on the effectiveness of blended learning blended geography course improved secondary students' attitudes toward the course by Garrison & Kanuka (2004) and Change (2004) showed that students learning in a blended format achieved higher overall test score grades while studies conducted by Annetta et al. (2009) reveals that students exposed

blended learning method is said to be gender bias in retention ability in favour of female students.

Therefore, the researchers used Computer-Based Blended Learning in Collaborative and Individualised Settings to ascertain its effectiveness on student's retention in chemistry in senior secondary schools. Also, to find out whether there is significant in student's retention in moles concepts as related to gender.

### **Statement of the problem**

The teaching and learning of chemistry in secondary Schools still remain a serious problem to chemistry teachers due to its abstract nature of the subject. The high rate of failure in senior secondary Certificate Examination (SSCE) has become a subject of constant comment. Several strategies were employed to improve Student's performance in school subjects in Nigeria among them is the use of computer-based blended learning strategy. However, the researchers were not sure if the strategy would improve chemistry students' retention in Moles Concept.

### **Research questions**

The following research questions were raised for the study: (1) what are the differences in the mean retention scores of students taught mole concept using Computer-Based Blended learning in Individualised and Collaborative Settings and those taught with lecture method; (2) what are the differences in the mean retention scores of male and female students taught mole concept using Computer-Based Blended learning in Individualised Settings; (3) what are the differences in the mean retention scores of male and female students taught mole concept using Computer-Based Blended learning in Collaborative Settings.

### **Research hypotheses**

The following null hypotheses were formulated and tested at 0.05 level of Significance

**HO<sub>1</sub>:** There is no significant difference in the mean retention scores of students taught mole concept using Computer-Based Blended Learning Collaborative and in Individualised settings and those taught with lecture method.

**HO<sub>2</sub>:** There is no significant difference in the mean retention scores of male and female students taught mole concept using Computer- Based Blended learning in Individualised settings.

**HO<sub>3</sub>:** There is no significant difference in the mean retention scores of male and female students taught mole concept using Computer- Based Blended learning in Collaborative settings.

### **Methodology**

The researchers adopted Quazi-experimental design which involves pre-test, post-test and control group design. All the groups were given Pre-test, Post-test and delayed Post-test. Experimental Group 1 was subjected to treatment using Computer-based blended learning individualise Settings and Experimental Group 2 was subjected to treatment using Computer-based blended learning collaborative Settings. The Control Group were taught using lecture method. The Population for the study was twenty-three public Senior Secondary Schools two Students (SS2) with total population of seven thousand and fifty-one (7,051) for 2015/2016.

The study was carried Chanchaca and Bosso Local government in Minna, Niger state. The researcher adopted purposive sampling techniques where School with well-equipped computer laboratories was used for experimental group2, the experimental group 1 was given a soft copy computer based instructional modules for individualise Settings since they have access to personal system in their homes and the control group was taught using lecture method. The students were randomly grouped as Experimental group one (40

students), Experimental group two (40 students) and Control group (40 students). A total of 120 students (Comprising of 71 females and 49 males) was sampled for the study.

Chemistry Achievement Test (CAT) was the research instrument used in collecting data to answer research questions and test hypotheses. CAT has 30 multiple choice items with four options (A-D) from where a student is expected to indicate the correct option to each item. The instrument covers different levels of understanding based on Blooms Taxonomy of Educational Objectives. CAT was subjected to face and content validity by three computer programming experts, two, Chemistry education experts and two test and measurement expert. A test retest method was used to determine the reliability of the instrument and a reliability coefficient of 0.74 was obtained using test-retest method.

Students in the experimental groups learnt moles concept using computer-based instructional modules in both collaborative and individualise settings respectively while the control group were taught using lecture method. Data collected from the administration of research instrument were analysed using inferential statistics. Analysis of covariance (ANCOVA) in statistical Package for Social Sciences (SPSS) 20.0 Version was used to test the three hypotheses while the level of significance was ascertained at 0.05 level.

## **Results**

*Hypothesis 1:* there is no significant difference in the mean retention score of secondary school students taught Moles Concept using Computer-based blended learning collaborative Settings, Computer-based blended learning individualise Settings and lecture method.

Table 1 indicates that an  $F(2, 119) = 56.24, p = 0.00$  for the main effect was significant at 0.05 alpha level. This implies that there is a significant difference in the retention score of students taught Moles Concept using Computer-

based blended learning Individualise Settings, Computer-based blended learning collaborative Settings and Lecture method. Hence the hypothesis was rejected. The result indicated that treatment using computer-based blended learning Collaborative, Individualise settings and lecture method produced significant difference on students' retention in moles concept. These findings on retention is in agreement with the earlier findings of Ibe (2013) and Akanbi & Kolawole (2014) in Biology and Agbi (2006) in Chemistry.

**Table 1.** Analysis of covariance result of mean retention scores of student's taught moles concept using computer-based blended learning strategy in individualized, collaborative settings and lecture method

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9318.250	3	3106.083	351.492	.000
Post test	7.100	1	7.100	.803	.372
Treatments	993.893	2	496.946	56.236*	.000
Error	1025.075	116	8.837		
Total	365793.000	120			
Corrected Total	10343.325	119			

\*: Significant at 0.05 alpha level

*Hypothesis 2:* there is no significant difference in the retention score of male and female students taught moles concept using computer-based blended learning individualise settings.

**Table 2.** Analysis of covariance result of mean retention score of male and female student taught moles concept using computer-based blended learning in individualized learning settings

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1516.707	2	758.354	74.846	.000
Intercept	508.440	1	508.440	50.180	.000
Posttest	6.200	1	6.200	.612	.439
Gender	1486.814	1	1486.814	146.741*	.000

Error	374.893	37	10.132
Total	99506.000	40	
Corrected Total	1891.600	39	

\*: Significant at 0.05 alpha level

The result of analysis in Table 2 indicates that an  $F(1, 39) = 146.741$ ,  $P = 0.00$  for groups was significant at  $0.05 \alpha$  – level. This indicates that there was a significant difference in the mean retention scores of male and female Moles Concept students taught using Computer-based blended learning individualise Settings in favour of Collaborative settings. Therefore, hypothesis five was rejected. On the other hand, gender has influence on the students taught Moles Concept using Computer-based blended learning individualised settings this might be as a result of female being phobia of carrying out instructional Settings on their own without showing them how to do it. This is in line with earlier findings of Anagbogu & Ezeliora (2007) in psychmotor skill, Orabi (2007) in introductory engineering, Adeyemi (2008) in social studies, Annetta et al. (2009) in machine a fifth grade forces and motion, Iwendi (2009) in mathematics and Abdu Raheem (2012) also in mathematics that gender significantly enhances the students’ retention.

*Hypothesis 3:* there is no significant difference in the retention scores of male and female students taught moles concept using computer-based blended learning collaborative settings.

The analysis in Table 3 indicates that there was no significant difference in retention of male and female students taught moles concept using computer-based blended learning collaborative Settings. The main effect of computer-based blended learning collaborative Settings on gender alone produced an  $F(1, 39) = 2.45$ ,  $P = 0.12$ . This result was not significant at the  $0.05 \alpha$  – level. This hypothesis was retained. It is in line with the earlier findings of Ifamuyiwa (2004) and Ifamuyiwa & Akinsola (2008) in mathematics; Kost et al. (2009) in introductory physics; and Olashinde & Olatoye (2014) in science which says

gender has no effect on retention when male and female students exposed to the same concept using the same settings.

**Table 3.** Analysis of covariance result of retention mean scores of male and female taught moles concept using computer-based blended learning in collaborative settings

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8.450 <sup>a</sup>	2	4.225	1.245	.300
Intercept	291.004	1	291.004	85.760	.000
Posttest	1.624	1	1.624	.478	.493
Gender	8.411	1	8.411	2.479 <sup>ns</sup>	.124
Error	125.550	37	3.393		
Total	153894.000	40			
Corrected Total	134.000	39			

NS: Not significant at 0.05 alpha level

### Conclusion

The result of this study provides empirical evidence that the use of computer –based blended learning collaborative setting enhances student retention in moles concept and Gender does not influence students’ retention where as in computer-based blended learning individualise settings and lecture methods where gender plays great impact on their retention ability. Therefore, Computer-based blended learning collaborative settings serves as alternative methodology to enhance teaching and learning.

### Recommendations

(1) Computer-based blended learning collaborative and individualised settings should be adopted by chemistry teachers in teaching and learning process in senior secondary schools in Nigeria. This could be achieved by training chemistry teachers on effective usage; (2) Computer-based blended learning collaborative and Individualised settings enhances students retention, therefore,

chemistry teachers, policy makers, textbook writer and other stakeholder should emphasise on the use of computer-based blended learning collaborative and Individualised Settings to enable students excel in national examinations; (3) Computer-based blended learning collaborative settings could bridge the gap between male and female academic disparity in chemistry. Therefore, computer-based blended learning collaborative settings used in this study should be used to bridge the gap between male and female achievement in senior secondary school chemistry.

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