

# Effects of Individualized and Cooperative Computer Assisted Instruction on Senior Secondary School Chemistry Students' Achievement in Niger State

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## Abstract

*This study examined the effects of individualized and cooperative computer assisted instruction on senior secondary school chemistry students' achievement in Niger state. A pretest - posttest control groups design was employed for the study. Three secondary schools were randomly selected and 20 students were randomly selected from each of the schools. Computer Assisted Package was developed and validated. A Chemistry Achievement Test (CAT) with reliability coefficient of 0.83 was used as instrument for data collection. Three null hypotheses were tested at 0.05 level of significance. Statistical Package for Social Sciences (SPSS) was used for the analysis using ANOVA. The findings from the study showed that there was significant difference between the mean achievement scores of students taught Chemistry using individualized and cooperative computer-assisted instructional package and those taught using conventional method. The result also showed that there was no significant difference in the mean achievement scores of male and female students in experimental groups I and II. From the findings, it was recommended that Government should as a matter of commitment equip schools with computer facilities, and Chemistry teachers should adopt individualized and cooperative assisted instructional strategies in teaching Chemistry concepts at the Secondary school levels.*

## Introduction

Information and Communication Technology (ICT) has changed the way human beings live, impacted different facets of life and has revolutionized the field of education, communication, health, service organization and a host of others. The place of ICT in school cannot be ignore, the advent of ICT in schools has made the process of teaching and learning easier (Ainsworth,2008). The use of ICT in the classroom has given rise to Computer Assisted Instruction software packages for classroom instructional purposes. According to Umaru (2003), Computer Assisted Instruction is a program of instruction or package presented as computer software for instructional purpose. Several researches have shown that using Computer-Assisted Instruction (CAI) has a positive effect on students achievement compared to traditional methods. the use of CAI provides the learner with different backgrounds and characteristics. Some of this researchers are observed that using teaching software such as CAI, makes the concepts to be presented to the students in such a well-organized manner that makes for greater clarity and easier understanding of science subjects ( Okoro and Etukudo,2001; Ezeliora ,2000; Paul and Babaworo 2006).

Chemistry is one of the major science subjects taught at senior secondary school level which focuses on studying the composition, properties and uses of matter. Chemistry is a very important subject as its knowledge is required for the successful study in very many important profession ( Aianah, 2008). Although most researchers have attested to the effectiveness of using CAI to teach science concepts solving the problem of large class size through the development of methods and approaches that promote student-student interaction through Cooperative Learning CL. Studies on CL have demonstrated the promotion of students' learning and social relations relative to more traditional whole class methods of teaching (Adeyemi, 2002; Bukola and Oludipe, 2012; Jumoke and Idowu, 2012). Also studies have shown that student using CAI cooperative learning strategies performs better than those student taught with individualized CAI (Hannafin,2006 and Okoro and Etukudo2001). Contrary to this some researchers found out that student taught using the individualized CAI had better achievement scores than those taught using Adedokun,2004 and Olubisi (2008), CAI cooperative learning strategies. Therefore there is the need to investigate further to find the effects of individual and cooperative computer assisted instruction on the achievement of senior secondary students in Chemistry in Niger state



### Statement of the Problem

Despite the importance of Chemistry in the Nigerian educational system and efforts made by teachers to enhance students' achievement in Chemistry, Secondary School Students' still perform poorly in Chemistry examinations at both WAEC and NECO Levels (Adesoji, 2004; Abimbola, 2013 and Osokoya, 2006). However several studies have been conducted by researchers to investigate the causes of students' poor achievement in Chemistry and the most recurring factor discovered in most of these researches is the poor application of teaching strategies and the use of obsolete instructional materials by teachers. All these have negative effects on gender learning of Chemistry (Adesoji, 2004; Abimbola, 2013 and Osokoya, 2006). So, this study investigated the effects of individualized and cooperative computer assisted instruction on the achievements of Senior Secondary School Students in Chemistry in Niger state.

### Purpose of the Study

The purpose of this study is to determine the effects of individualized and cooperative computer assisted instruction on Senior Secondary School Chemistry Students' achievements. It pursued the achievement of the following objectives:

1. To find out the difference between the achievements of students taught Chemistry using Individualized and Cooperative Computer-Assisted Instruction and those taught using Conventional teaching method.
2. To determine the difference between the achievement of Male and Female students taught Chemistry using individualized Computer-Assisted Instructions.
3. To investigate the difference between the achievement of Male and Female students taught Chemistry using Cooperative Computer-Assisted Instruction.

### Research Questions

The study attempted to answer the following questions:

1. Is there any difference between the mean achievement scores of students taught Chemistry using Individualized and Cooperative Computer-Assisted Instruction and those taught using Conventional teaching method?
2. Is there any difference in the mean achievement scores of Male and Female students taught Chemistry using individualized Computer-Assisted Instructions?
3. Is there any difference in the mean achievement scores of Male and Female students taught Chemistry using Cooperative Computer-Assisted Instruction?

### Null Hypotheses

The following null hypothesis were formulated and tested at 0.05 level of significance.

**HYPOTHESIS ONE (HO<sub>1</sub>):** There is no significant difference between the mean achievement scores of students taught Chemistry using individualized and cooperative computer-assisted instruction and those taught using conventional teaching method.

**HYPOTHESIS TWO (HO<sub>2</sub>):** There is no significant difference in the mean achievement scores of Male and Female students taught Chemistry using individualized Computer-Assisted Instructions.

**HYPOTHESIS THREE (HO<sub>3</sub>):** There is no significant difference in the mean achievement scores of Male and Female students taught Chemistry using Cooperative Computer-Assisted Instruction.

### Methodology

A pretest – posttest randomized nonequivalent group design was adopted for the study. The population of the study comprised of all the Senior Secondary School Chemistry Students in Minna Metropolis. There were two experimental groups and one control group. The experimental group I used Computer Assisted Instruction (CAI) individually while experimental group II used Computer Assisted Instruction (CAI) in groups. The control group was taught using traditional Instruction (TI) method.

The population for this research was made up of all Senior Secondary School students in Minna Metropolis. The sample was made up of sixty (60) students randomly selected from three Secondary Schools in Minna Metropolis. Twenty students were randomly selected from each of the schools. Two



instruments were used for this study, Computer Assisted Instruction package on electrolysis was developed by the researcher which was validated by two experts in the area of Educational Technology. The second instrument was Chemistry Achievement Test (CAT) adapted from West African Examination Council (WAEC) question papers of June/July Examinations which consist of 30 multiple choice questions with option A-E. The face and content validity of the instrument was determined and a reliability coefficient of 0.81 was established. The study lasted for six weeks. Data collected were analyzed using Analysis of Covariance (ANOVA).

### Results

The data collated was analyzed and presented in the tables below.

**Table 1: ANOVA Comparison of the Pretest Mean Scores of the Experimental and Control Groups**

Sources of Variables	Sum of Squares	df	Mean Square	F-cal.	F-critical	P
Between groups	3.552	3	1.184			
Within groups	154.782	56	2.764	0.428	3.15	0.733
<b>Total</b>	<b>158.33</b>	<b>59</b>				

Not significant at  $p < 0.05$

Table 1 presents the ANOVA result of the comparison of pretest mean scores of the experimental groups I, II and the control group. The analyses showed that  $P > 0.05$ . This indicates that the students were nearly equivalent at the entry level before the treatment was given.

**HYPOTHESIS ONE (H<sub>0</sub>):** There is no significant difference between the mean achievement scores of students taught electrolysis using individualized and cooperative computer-assisted instruction and those taught using conventional lecture method.

**Table 2: ANOVA Comparison of the posttest Mean Scores of the Experimental Groups I, II and the Control Group**

Sources of Variables	Sum of Squares	Df	Mean square	F-cal	F-critical	Significant level
Between groups	157.633	2	78.817	47.116	3.15	0.000
Within groups	95.350	57	1.673			
<b>Total</b>	<b>252.983</b>	<b>59</b>				

Significant at 0.05 levels.

Table 2 showed that there was significant difference between the groups at  $P < 0.05$ . This implies that the null hypothesis was rejected. In order to determine the source of the differences, a post hoc test was conducted using Scheffe's Multiple Comparison Test.

**Table 3: Scheffe's Post-hoc Analysis of the Groups Mean Score**



Variables (i)	Variables (j)	Mean Difference(i -j)	significance
Experimental group I	experimental group II	0.3500	0.695
control group		3.600	0.000
Experimental group II	experimental group I	-0.3500	0.695
control group		3.2500	0.000
Control group	experimental group I	-3.600	0.000
experimental group II		-3.250	0.000

Significant at 0.05 level

Table 3 showed the Schffe's analysis of the three groups indicated that the observed significant differences were from the mean scores of the Experimental group I (individualized learning) and the control group.

**HYPOTHESIS TWO (HO<sub>2</sub>):** There is no significant difference in the mean achievement scores of Male and Female students taught Chemistry using individualized Computer-Assisted Instructions.

**Table 4: t-test Comparison of the posttest mean scores of male and female in experimental group I**

Variables	N	Df	Mean (X)	SD	t-value cal.	t-value critical	Significant
<b>Male</b>							
Experimental group I	10		8.800	0.63246			
<b>Female</b>		18			0.256	1.734	0.801
Experimental group I	10		8.700	1.05935			

Not significant at 0.05 level

The result on table 4 showed that the result is not significant at  $P > 0.05$  level of significant ( $P=0.801$ ). This implies that there was no significant difference in the mean achievement of male and female students in experimental group I using Individualized Computer Instruction. Thus, the hypothesis was not rejected.

**HYPOTHESIS THREE (HO<sub>3</sub>):** There is no significant difference in the mean achievement scores of Male and Female students taught Chemistry using Cooperative Computer-Assisted Instruction.

**Table 5: t-test Comparison of the posttest mean scores of male and female in experimental group II**

Sources of variables	No. of sample	Df	Mean (X)	SD	t-value cal.	t-value critical	Significant
<b>Male</b>							
Experimental group II	10		8.20	0.91894			
<b>Female</b>		18			0.878	1.734	0.044
Experimental group II	10		7.60	1.95505			

Not significant at 0.05 level

Table 5 showed that there was significant difference at  $P < 0.05$  level of significant ( $P=0.044$ ). This implies that there was significant difference in the mean achievement of male and female students in experimental group II. Therefore, the null hypothesis was rejected.



## Findings

The findings from the study are presented below:

1. There was significant difference between the mean achievement scores of students taught Chemistry using Individualized and Cooperative Computer - Assisted instruction and those taught using conventional teaching method.
2. There was no significant difference in the mean achievement scores of Male and Female students taught Chemistry using individualized Computer-Assisted Instructions.
3. There was significant difference in the mean achievement scores of Male and Female students' taught Chemistry using Cooperative Computer-Assisted Instruction.

## Discussion of Results

The findings of the study showed that the use of individualized and cooperative computer assisted instruction in teaching electrolysis in Chemistry improved students' achievement when compared with the conventional teaching method. It also showed that students taught electrolysis in Chemistry using the individualized assisted instruction had a higher mean score than the cooperative assisted instruction. This could be attributed to the fact students in the experimental group I studied individually using the computer assisted instruction without distraction from their peer and also are able to learn at their own pace and at their own convenience which otherwise would not have been possible if they are to work in a group. The result of this study also did not come as a surprise owing to the fact that most students these days make use of phone where this instructional package can be installed were the learnt material can be studied at convenience over and over again by the students for better understanding.

This finding is contrary to Okoro and Etukudo (2001), who found that the students taught Chemistry had higher achievement scores than individualized CAI and conventional method of teaching. It also contradicts findings of studies of David, Fajola (2000), and Hannafin (2006) whom in an independent study found that the students taught using cooperative CAI performed better than student taught with individualized CAI and conventional method of teaching. However findings from the study agrees with the study of Ash, (2005), and Bastuk (2005), who discovered that there is a significant difference between the performance scores of student taught with Individualized Computer Assisted Learning and those taught with the tradition teaching method. The result of the study also revealed that there was no significant difference in the achievement of male and female student taught Chemistry in both experimental group I and experimental group II. The finding is agreement with the study of Ash (2005) and Bastuk (2005), who reported that there was no significant difference in the academic achievement of male and female students taught physics using CAI and those taught using the conventional method of teaching. However, result of the study is contrary to that of George and Barry (2007) and Fajola (2000) which report that boys achieved better than girls in the CAI group. This implies that the achievement of Chemistry students in the two experimental group was not gender bias.

## Conclusion

1. The study examined the effects of individualized and cooperative computer assisted instruction on Chemistry students achievements. Findings from the study showed that the two experimental groups had higher achievement mean scores than the control. It also revealed that the individualized computer assisted instruction had more positive effect on Chemistry students achievement than the cooperative computer assisted instruction. Finally findings from the study showed that there was no significant difference in the mean achievement scores of Male and Female students taught Chemistry using individualized Computer-Assisted Instructions. And there was significant difference in the mean achievement scores of Male and Female students' taught Chemistry using Cooperative Computer-Assisted Instruction.

## Recommendations

- Based on the findings of this study; the following recommendations were made:
1. Chemistry teachers should adopt individualized and cooperative assisted instructional strategies in teaching Chemistry concepts
  2. Government should as a matter of commitment equip schools with adequate computer facilities.
  3. Seminars, workshops and conferences should be organized regularly for Chemistry teachers on the use of computer assisted instructions



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