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# Use of computer supported collaborative learning in teaching and learning science in Nigeria

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## Abstract

This study investigates the use of computer supported collaborative learning in teaching and learning science in Chemistry Teaching in Senior Secondary Schools in Obio/Akpor Local Government Area in Rivers State. Two research questions and two hypotheses were formulated to guide the research. The design adopted for this study is quasi experimental pre-test, post-test control group design. The population of the study was made up of all SSII chemistry students, using cluster sampling to select 40 students to form the sample size. The research instrument used was Balancing of Equations Performance Test (BEPT). Mean and standard deviation were used to answer the research questions. Analysis of Covariance (ANCOVA) was used to test the hypotheses. The findings among others indicated that students taught with computer supported collaborative learning teaching strategy performed better than the traditional method thereby eliminating student's misconception on balancing of equations concept in chemistry. It was recommended among others that chemistry teachers should be encouraged to explore the application of computer supported collaborative learning strategy in their classroom instruction.

**Keywords:** Computer; Collaborative learning; Chemistry teaching; Performance

## 1. Introduction

Science subjects are core subjects in Nigeria educational curricula, out of which one must be offered at senior secondary school level. Their importance in technology development of any nation make them Imperative for their inclusion in the curriculum for science oriented students (FRN, 2014). In spite of their importance students' performance at senior secondary Certificate Examination in secondary schools In Nigeria has been less than 50percent for the past ten years West Africa examination Council WAEC Report,2012).

Adegoke (2011) Reported that students are actively involved in developing knowledge; they receive information passively and are less motivated. The instructional method employed by the teacher plays an important role in acquisition of skills and meaningful learning. However, the lecture method/conventional method used by teachers have been criticized because only hard-working students can benefit from it. The poor performance of students in science can be improved with innovative teaching and learning methods integrated with technology and elements of problem solving Gambari, 2010).

Computer technology has ushered in a new era of mass media, bringing with it great promise and great concerns about the effect on students' development and well-being. It has been found to be an effective device for classroom instruction using different software Yusuf & Afolabi; 2010).

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Therefore computer assisted instruction CAI) is designed normally for individual learning, but it has been found to be more effective with cooperative learning than individualized instruction (Johnson & Johnson, 2008). The Use of computer as a medium for operative learning is referred to as computer supported cooperative learning and it has been embraced in developed nations (Johnson and Stanley, 1996; Schmidt, 2002). Cooperative learning, though different in some ways from collaborative learning, also contributes to the success to teams in CSCL environments. The five elements for effective cooperative groups identified by the work of Johnson and Johnson are positive interdependence, individual accountability, promotive interaction, social skills and group processing Johnson, Johnson and Holubeck, 2002). Because of inherent relationship between cooperation and collaboration understanding of what encourages successful cooperation is essential to CSCL research.

Cooperative learning is an instructional strategy whereby students are encouraged to work together on learning tasks( slaving, 1995). In cooperative, teaming students work face to face to complete a given task collectively. Cooperative learning setting encourages students to work together to attain group goals, instead of working individually or competitively (Zakaria & Iksan, 2007). Students discuss subjects matter, help each other learn, and provide encouragement for members groups of the group. Positive interdependence where each other learn, and provide encouragement for members of the group. Positive interdependence where each student must believe that they have a key role to play in the group; individual accountability where each student within a group must be accountable for mastery of the instructional content presented; group rewards that entails social skill for effective collaboration among others key elements of cooperative learning ( Slaving, 1995).

To enhance the understanding of science concepts, students must be more active in the classroom and must creatively acquire knowledge, especially in understanding and solving science problems. According to Zakaria, Soldiering, Dundee & Abiding (2013) students should be given the opportunities to develop, interact, and share with friends through collaborative/Cooperative learning activity so that the cognitive and affective development of Students in science can be improved. Computer supported supported collaborative learning (CSCL) is focused on how collaborative learning supported by technology can enhance peer interaction and work in groups and how collaboration and technology facilitate sharing and distributing of knowledge and expertise among community members ( Lippomen, 2002). Development in information and communication technology (ICT) offer increasing possibilities for collaborative learning. Example, technology enhanced learning environments can provide advanced means for the production of knowledge and constructive communication, and interactive and collaborative learning in (and between) classrooms and between teachers and learners. CSCL is considered as one of the most promising innovations to improve teaching and learning with the help of modern information and communication technology (De Corte, 1996; Lehtinen, Hakkarainen & Lipponen, 1999). Collaborative learning refers to an instructional method whereby students are encouraged or required to work together on problem solving or learning tasks in its ideal form the collaboration involves the mutual engagement of learners in a coordinated effort to solve a problem or to acquire together new knowledge (Lehtinen et al; 1999). As such collaborative learning is a method that is in line with the new conceptions of learning and opposed to traditional ' direct transmission' model, in which learners are assumed to be passive, receptive, isolated receivers of knowledge and skills delivered by an external source (De Corte, 1996; Verschaffel et al, 1998).

The potential benefits of Computer Assisted Instruction (CAI) cannot be underestimated in the contemporary world since there are established findings on the instructional value of computers, particularly in advanced countries (Gambari et al., 2013). The Integration of ICT in the teaching and earning process has been adopted through the use of computers and other technological gadgets for curriculum content delivery (Ayuba and Timayi, 2018). The computer could be accessed individually or as a group unlike in a conventional classroom where students arelumped together irrespective of their individual differences and class size (Laleye, 2019).The use of ICT in teaching is a relevant and functional way of providing education to learners in order to assist them developing the required capacity for the world to work (Kosoko-Oyedeko & Tella, 2010).

### 1.1. Statement of the Problem

Science is the hall mark of technological advancement. Knowledge of science helps man to understand the working of the planets of the universe. Learning science in the 21st century is aim at training students to be able to understand concepts, develop process skills and also develop thinking abilities to be able to transfer knowledge (Aidoo, Boateng, Kissi and Ofori, 2016). Science comprises of basic discipline such as physics, chemistry and biology.

Biology is one of the core science subjects offered in senior secondary school in Nigeria. Biology gives students a glimpse of scientific exploration and opportunity that are needed for discovering. Biology have contributed immensely towards improved quality of human life by providing information on drug abuse, biotechnology, genetic engineering and molecular biology. Various researchers have observed that there is an increasing yearly enrolment in senor secondary

school examination in biology, but each year candidate achieve poorly in the examination (Nnorom, 2015; Okoye, 2010). Also, West Africa Examination Council annual report 2015 - 2017 shows that only 26 percent of the candidates who wrote the 2017 senior secondary certificate examination SSCE had five credits including biology, Maths and English representing a sharp drop in the results recorded in 2016 (Nnorom, 2015). Nnorom (2015) remarked that the percentage of candidate in this category in 2015 and 2016 examination were 28.59 percent and 38.50 percent respectively. This has become a worry to school principals, teachers, stakeholders as to the real cause of the problem.

The West Africa Examination Chief Examiner report 2015 – 2017 reported that the persistent decline in students performance in science was as a result of lack of resources such as teaching aids, lack of content knowledge by teachers. Other factors include large class size, materials for the practical lesson, and ineffective teaching method (Okeke, 2018).

Moreover, to improve the performance of students in science especially biology, Kolawole (2007) suggested that a more engaging teaching method should be employed by teachers. According to him, the methods include discussion method, collaborative, expository, project method, problem based solving technique among others.

Researchers have shown that most teachers continue to use ineffective and teacher centered method such as conventional method in teaching (Chukwuemeka, 2016; Ogbu, 2011). Teaching should be based on the student's previous knowledge and connection between the experience of student and biological concept (Chukwuemeka, 2016). Berkeley (2015) noted that the teacher centered method does not promote skill acquisition, objectivity and critical thinking ability among students. There is the need for more activity oriented, students centered and innovative method that can develop in the students science process skills, which include problem based solving method.

The purpose of this study is to investigate;

- The difference in the performance of senior secondary two school students taught Biology using computer support collaborative learning and those taught using conventional classroom setting.
- The difference in the performance of male and female students taught using computer supported collaborative setting and those taught using conventional classroom setting.

### 1.2. Research Questions

The research questions developed to guide this study are:

- Is there any difference in the performance of secondary school students taught chemistry using computer supported collaborative learning and those taught using conventional classroom setting?
- Is there any difference in the performance of male and female students taught Biology using computer supported collaborative setting?

### 1.3. Research Hypotheses

The following null hypotheses were tested in the study.

- There is no significant difference in the performance of secondary school students taught chemistry using computer supported collaborative learning and those taught chemistry using conventional classroom setting.
- There is no significant difference in the performance of male and female students taught chemistry using computer supported collaborative learning.

## 2. Computer Assisted Instruction (CAI)

CAI, according to Edutech202 (2012) is an automated instructional technique in which a computer is used to present an instructional programme to the learner through an interactive process. Audu and Agbo (2010) view CAI as an instructional technique in which the computer instructs the students and the computer contains a stored instructional programme designed to inform, guide, control and test the students until a prescribed level of proficiency is reached.

Sharma (2017) understands CAI as an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. Eyo (2018) in like manner, sees CAI as a self-learning technique, usually off-line or online using the computer as a tool to facilitate and improve instruction. CAI is simply the type of instruction aided by a computer-controlled display and a response entry device which uses a combination of

text, graphics, sound and video to enhance the learning process through interaction, to achieve certain instructional goals and improve educational outcomes.

Okebukola (2013) postulated that CAI can be applied to all ages and forms of education, from pre-school to professional school and even in many employment areas. It can also be used in a wide range of fields including all the main disciplines in elementary and secondary school. Edutech202 (2012) summarized the characteristics of CAI to include learner-controlled instruction, prompt feedback to the learner, self-pacing, adaptability of instruction, multiple-user approach and random-access facilities. CAI uses diverse applications to present topics, test students' understanding, receive immediate feedback and summarise students' performance (Patel, 2013).
CAI methods of delivery are classified into drill and practice, tutorials, simulation, problem solving approaches, educational games, discovery mode and dialogue level. Drill and practice is the commonest used CAI application due to its simplicity. It usually provides different set of questions in varied formats. At each stage, the computer asks questions and seeks responses objectively, using a very repetitive type of procedure (Eyo, 2018). Most drill and practice programs have a tracking device that enable students (and teachers) to monitor their progress. In addition, drill and practice activities have sounds and other motivating characteristics that encourage students to progress at their own rate while using the software (Mukuna, 2013).

Tutorials are computer programs where the computer acts as an instructor. It is used in teaching new topics. The computer presents and teaches new concepts and principles and once the learner exhibits clear understanding, the learner immediately goes over to the next activity (Busari, Ernest & Ugwuanyi, 2016). Tutorial activity includes both the presentation of information and its extension into different forms of work, including drill, practice, and simulation (Sharma, 2017). Tutorials are often very interactive. Some tutorials capitalize on individualized instruction and adjust the pace and feedback based on the students' progress (Nwanne & Agommuoh, 2017)
Dialogue level is a form of CAI application that involves sophisticated interaction between the learner and the computer (Torruam & Abur, 2013). The learner interacts with the machine by asking questions and providing responses, to which the computer program reacts appropriately.

(Adeshina, 2015). Simulation is a program that models real life situations and enables the students to manipulate and experiment with it (Anyamene, Nwokolo, Anyachebelu & Anemelu, 2012). It involves using the computer to represent the operation of a system in a real-life situation (Audu & Agbo, 2010). Simulation software can provide an approximation of reality that does not require the expense of real life or its risks (Reffell & Whitwort, 2010). The justification for using simulations is where the reality may be too expensive, too dangerous or too time consuming (Thang & Wong, 2010).

In discovery, the inductive approach to teaching and learning is followed. The learner is encouraged to proceed through trial and error by solving a given problem (Audu & Agbo, 2010). The problem-solving approach helps children develop specific problem-solving skills and strategies (Torruam & Abur, 2013). Problem solving software does not necessarily utilize realistic.

### 2.1. Empirical Review

Yusuf and Afolabi (2010), investigated the effects of CAI on secondary school students' performance in biology. A sample of 120 first year senior secondary school students (SSS I) from three private secondary schools, in Oyo State, Nigeria was used. The students' pre-test and post test scores were subjected to analysis of covariance (ANCOVA).The findings of the study showed that the performance of students exposed to CAI either individually or cooperatively were better than that of their counterparts who were exposed to the conventional classroom instruction.
Adeshina and Hanna (2016) also carried out a study that investigated the effects of CAI on independent learning skills of economics students in secondary Schools in Kaduna State, Nigeria. A two-by-two pre-test, post-test quasi experimental control group design was adopted. A targeted population of twenty-three thousand four hundred and sixty (23,462) public senior secondary students (SS2) in twelve educational zones of Kaduna State was used. The results revealed that students taught with the use of CAI performed significantly better than those taught without CAI.

Samaila et al., (2016) conducted research on the development of computer aided instruction for effective teaching of biology at the Nigeria Certificate in Education (NCE) technical level in north eastern Nigeria. CAI was tested by using it to teach an experimental group (S1), while control group (S2) was taught using the lecture method. The results of the study revealed that there was variation between the mean scores of students taught about the use of electrical and electronic devices using CAI and students taught using the lecture method. The CAI was found to be effective in teaching use of electrical and electronic devices. In a related development, Laleye (2019) used a quasi-experimental pre-test-posttest design to find out the efficacy of a computer assisted instructional package (CAIP) on students' performance in basic science in Ondo State, Nigeria. Two secondary schools were purposively selected and assigned to experimental

groups 1 and 2 in equal numbers. Students in experimental group 1 were exposed to CAIP individually and experimental group II in cooperative groups. An equivalent school was selected as the control. The results of the analysis revealed that students taught withvthe developed package performed significantly better than their counterparts taught with the conventional method of instruction.

Alasoluyi (2015) conducted a study to examine the effect of CAI on students' performance in Biology in senior secondary schools in Ekiti State, Nigeria. Public senior secondary schools in Ekiti State were used to compare the performance of students taught using the CAI method with the performance of the group taught using a traditional method. The findings of the study revealed a significant difference in the post-test performance scores of students taught economics with the use of a CAI enhanced method when compared with those taught using the traditional method of instruction. The study found that students taught using CAI performed better and scored higher. Likewise, Gambari et al., (2013) carried out a study on students' perception towards the use of computer assisted instruction on learning mathematics in Minna, Niger State, Nigeria. 540 students (270 male and 270 male) from six secondary schools in Minna formed the sample for the study. The findings revealed that the majority of the students have a positive perception toward the use of CAI. The implication is that the students perceived the use of CAI as a way of improving their performance in mathematics.

Eyo (2018) conducted a study that investigated the effects of a computer assisted multimedia instructional (CAMI) package on secondary school students 'achievement in biology in two educational zones of Niger State, Nigeria. The sample comprised of 364 students (206 boys and 158 girls) selected from six senior secondary schools in two educational zones. The samples were divided into an experimental group and a control group. The experimental group was taught using a CAMI package while the control group was taught using lecture method. The findings of the study showed that students in the experimental group achieved significantly better than their counterpart in the control group. Busari, Ernest and Ugwuanyi (2016) carried out research on the effect of CAI on senior secondary students' achievement in chemical reaction and equilibrium in Egbeda local government area of Oyo State, Nigeria. The instrument used in the study was the chemical reaction and equilibrium achievement test (CREAT). The students' scores from CREAT were collected and analyzed using mean and standard deviation to answer the research questions. The results showed a significant difference between the mean achievement of students taught chemical reaction and equilibrium using CAI and those taught using a conventional teaching strategy. Thus, the students taught using CAI performed better than their counterparts.

Kosoko-Oyedeko and Tella (2010) conducted a study to examine teachers' perception of the contribution of ICT to the pupil's performance in biology. A population of 200 primary school teachers selected through census from 15 schools in Epe local government, Lagos State, Nigeria was used. A modified questionnaire known as teacher's perception of ICT contribution to pupil's performance was used to gather the data for the study. Data collected was analysed using percentages and t-test statistical tools. The result indicated that teachers had a strong perception that ICT contributes to the performances of the pupils in CREAT.

Umar (2014) conducted a study on the effects of CAI on the teaching of social studies education in junior secondary schools in Jigawa State, Nigeria. A computer assisted instruction and social studies education questionnaire (CAISSQ) was used to elicit information from a sample of 340 students. The students were divided into experimental and control groups. The data obtained were analyzed by using t-test and descriptive statistics. The research finding showed that the use of computers in teaching social studies greatly enhanced the teaching and learning of the subject more effectively.

Stahl (2002a) argues that an adequate theoretical foundation for CSCL must explain how individual practices are social without forgetting that the social is grounded in individual activities, concepts of praxis, activity, social reproduction, structuration and enactment begin I address dialectic. More generally, Stahl's foundation, as detailed in Koschmann's more elaborated definition of CSCL (2002), includes the study of "the ways in which these meaning-making) practices are mediated through designed artifacts". Here Koschmann inters mainly to software objects designed to support collaborative learning, precisely CSCL technology, acting as meditational artifacts.

It was reported that CSCL is considerably more effective than conventional classroom instruction, in that several studies revealed that collaborative learning enhanced better performance among students in Biology, (Altiparmak and Nakiboglu-Tezer, 2009), in Mathematics (Solfitri, Daud and Abidin, 2013) and in Biology (Doymus, 2008; Jonsoon, msook, & Coll, 2008) in Biology respectively. Though, Shaahan, 2006; Seabborn and Wilson, 2002; and Thompson and Pledger, 1998 found no significant difference in the achievement of students taught using collaborative and those taught using conventional classroom and discussion methods respectively. The findings on the use of collaborative learning are inconclusive; therefore, this study examined the effects of computer-supported collaborative learning on performance in sciences and chemistry as the subject to be used for this study.

Gender has been identified as one of the factors influencing students' performances in sciences at senior secondary school level. However, Oluson (2002) reported females -'formed better when taught mathematics using collaborative learning. But, Khairulanuar, Nazre, Sairabanu, and Norasikin (2010) found gender differences in favour of male students. Also, Annetta, Mangrum, Holmes, Collazo and Cheng (2009), Kost, Pollock and Finkelstein 2009), Adeyemi (2008) and Ajaja & Eravwoke (2010) reported that gender had no effect on academic performance of students in collaborative learning. All these contradictory findings have necessitated the inclusion of gender as one of the moderating variables for this study. The findings reviewed on collaborative learning on gender show inconclusiveness on the learners. Previous studies focused on comparative effects collaborative learning strategies and Bhssroom instruction without examining the effectiveness of computer supported collaborative learning setting in Biology. Hence, based on these facts the present study examined the effects of computer-supported collaborative learning strategy on secondary school students' performance in Biology.

## 3. Methodology

The study design is a quasi - experimental consisting of treatment group or experimental group and a control group, since the classes existed as intact groups. In this study a three- stage sampling technique was adopted. First, a purposive random sampling was used to select two secondary schools in Rivers State Nigeria. These schools were selected based on the following criteria: equivalence (laboratories, facilities and manpower), school ownership (public schools), gender composition (mixed schools), ICT facilities (Computer Laboratories), and candidates' enrollment (Senior Secondary School Certificate in Biology for a minimum of 10 years). Second, intact class in each of the two schools were selected and randomly assigned to experimental and control groups using simple random sampling technique. Third, the subjects were arranged into different strata based on gender (male and female). This study consisted of 40 students from two groups consisting of 22 students in the control group and 18 students in the experimental group. The experimental groups were exposed to computer support collaborative learning (CSCL) while the control group was taught with conventional classroom method. Also, the students in the experimental groups were heterogeneously divided into groups with three members each, composed of students of different gender. In order to avoid bias in grouping, team portrait, team vision statement, classmate scavenger hunt, and card sort team building structure were used in each school respectively. Also, the teacher to implement the computer supported collaborative learning strategy underwent training on the use of collaborative learning in order to ensure that it was implemented as planned. The students were extensively trained for two weeks on the principles and practice of collaborative learning strategy. Computer assisted learning package (CALP) was used for test instrument.

The (CALP) was self-developed package for senior secondary chemistry used for instructional setting (Collaborative). It was validated by computer programmers and educational technology experts; subject content (Biology) medalists; and finally, field tested on samples representative similar to the students = used for the final study. The package contained of two topics which were subdivided eight lessons. It consisted of introduction, students' registration, list of lessons as in lesson 1,2,3,4 ...8 and the end. The package adopted the drill and practice modes of computer assisted learning. Biology Achievement Test BAT was used in collecting lie data after completion of instruction. Post tests were conducted to determine the difference between the groups. The BAT consisted of 50 multiple choice objective items adopted from past examination of West African Examination Council

(WAEC, May/June, 2005-2013) and National Examination Council (NECO, 2003-2010). The test (BAT) was based on the contents taught by CALP and the conventional classroom setting. The items are multiple choice in which students indicate the right option by ticking. BAT was administered to the experimental and control groups as pre-test and again for the post-test after it had been reshuffled. The items were validated and tested for reliability using 20 randomly selected SSII students. A reliability coefficient of 0.91 was obtained using the Kudar Richardson (KR-21). The study covered six weeks but the treatment period lasted for three weeks. During the study the experimental group was exposed to computer supported collaborative learning strategy as treatment while the control group was exposed to conventional classroom method. BAT was administered as pretest and posttest and the data collected during the study was analyzed using Analysis of Covariance (ANCOVA) and Scheffe's test using Statistical Package for Social Sciences (SPSS) version 11 at 0.05 alpha levels.

## 4. Results

The results are presented based the on the research hypotheses:

Research question 1: Is there any difference in the performance of secondary school students taught chemistry using computer supported collaborative learning and those taught using conventional classroom setting?

**Table 1** Mean scores of students taught Biology using CSCL and conventional classroom method

| Group | N | Mean | Std. dev |
|---|---|---|---|
| CSCL | 22 | 72.90 | 11.21 |
| Conventional Classroom | 18 | 59.61 | 3.88 |

The data on students' achievement in table I revealed that students taught chemistry using CSCL had mean score of 72.90 with standard deviation of 11.21 while the mean achievement score of students taught with conventional lecture method was 59.61 with standard deviation of 3.88. Students taught chemistry using CSCL method therefore, performed better than students taught using the conventional lecture method.

Research question 2: Is there any difference in the performance of male and female students taught Biology using computer supported collaborative setting?

**Table 2** Mean scores of male and female taught with CSCL

| Variable | N | Mean | Std. dev |
|---|---|---|---|
| Male | 13 | 75.15 | 14.03 |
| Female | 9 | 69.66 | 3.80 |

The data on students' achievement in table I revealed that students taught chemistry using CSCL had mean score of 72.90 with standard deviation of 11.21 while the mean achievement score of students taught with conventional lecture method was 59.61 with standard deviation of 3.88. Students taught chemistry using CSCL method therefore, performed better than

HO1: There is no significant difference in the performance of secondary school students taught Biology using computer supported collaborative learning and those taught using conventional classroom teaching method.

**Table 3** ANCOVA post test on experimental and control groups of Biology students

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 1750.679[a] | 1 | 1750.679 | 22.971 | 0.000 |
| Intercept | 173859.879 | 1 | 173859.879 | 2281.235 | 0.000 |
| TM | 1750.679 | 1 | 1750.679 | 22.971 | 0.000 |
| Error | 2896.096 | 38 | 76.213 | | |
| Total | 183805.000 | 40 | | | |
| Corrected Total | 4646.775 | 39 | | | |

a. R Squared =0.377 (Adjusted R Squared =0 .360)

Table 4.3 shows the main effect of treatment group (computer supported collaborative learning) on students performance on F (1,38)=22.97, P= 0.000) for the main effect (treatment) was significant, this indicates that the method of instruction produced a significant effect on the post achievement scores of students when covariate effect pre-test) was controlled. The result indicated that the treatment accounted for the difference in the post-test achievement scores of the students. Therefore, hypothesis one was rejected. Hence, there was significant difference between students taught using computer supported collaborative strategy and conventional classroom method.

HO2**:** There is no significant difference in the performance of male and female students taught Biology using computer supported collaborative setting.

**Table 4** ANCOVA showing the performance of male and female students

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 160.126[a] | 1 | 160.126 | 1.291 | 0.269 |
| Intercept | 111538.126 | 1 | 111538.126 | 899.613 | 0.000 |
| Sex | 160.126 | 1 | 160.126 | 1.291 | 0.269 |
| Error | 2479.692 | 20 | 123.985 | | |
| Total | 119586.000 | 22 | | | |
| Corrected Total | 2639.818 | 21 | | | |

a. R Squared = 0.061 (Adjusted R Squared = 0.014)

Table 3 indicates that the main effect of treatment on gender produced an F (1,20) =, 1.291, P**=** 0.269 which was not significant at 0.05 alpha level. This shows that there was no significant different between the posttest mean scores of male and female students. Male students' scores did not differ significantly from their female counterparts when both were taught using computer-supported collaborative learning.

Therefore hypothesis two was not rejected. The mean gain scores between the pretest and posttest for male and female students are illustrated below in table 4.

## 5. Discussion of Findings

The result of hypothesis one indicates a significant difference in students' performance in the experimental group. As regards better performance of students in collaborative learning as compared to conventional classroom method agree with earlier findings of Keramati (2010), Yusuf, Gambari and Olumorin (2012) in Physics and Yusuf & Afolabi (2010) in Biology which reported that students taught using computer-supported CA! performed better than those taught using conventional classroom method. Also the findings is supported by the findings of Altiparmak & Nakiboglu-Tezer (2009) in Biology, Lai and Wu (2006) in Nursing education, Hanze and Berger (2007) and Berger and Hanze (2009), (Gambari, 2010) in Physics**,** Moreno (2009), Daymus, (2008) and Janson, Somsook, and Colt (2008).

Zakana, Sotfitri, Daud & Abidin (2013) in Mathematics reported that CSCL is considerably more effective than conventional classroom instruction. However, the finding disagree with the findings of Shaaban (2006), Ross, Seabborn and Wilson (2002) and Thompson and Pledger (1998) who found no significant difference in the achievement of students taught using CSCL strategy and those using conventional classroom and discussion methods respectively.

The results of the analyses related to the hypothesis two indicated no significant difference in the performance of male and female students taught Biology using computer-supported collaborative learning. The findings as regards the performance of male and female students in the experimental group differ from the earlier findings of Olson (2002) which reported that females performed better than male students when taught mathematics using collaborative learning. It also disagree with Khairulanuar, Nazre, Sairabanu, and Norasikin (2010) which found gender differences in favour of male students. However, it corroborates the findings of Annetta, Mangrum, Holmes, Collazo and Cheng (2009), and Kost, Pollock and Finkelstein (2009) which reported that gender had no influence on academic performance of students in collaborative learning.

These findings have strong implications for teaching and learning of chemistry Biology in secondary schools in Nigeria using computer-supported collaborative learning strategies.

Furthermore, the findings provide sound empirical basis which indicated that performance of students in Biology greatly improved if students are exposed to computer-supported collaborative learning strategy.

### *Recommendations*

Based on the major findings of this study the following recommendations are proffered.

- Science teachers should expose science students to computer supported collaborative instructional strategy so as to improve students' performance in science.

- Government, educational agencies and other education stakeholders should organize workshops on the use of computer supported collaborative learning strategy to enhance better performance of science students.
- Science teacher education programme in Nigerian tertiary institutions should be improved upon to prepare innovative teaching approach (computer supported instructional strategy) which will promote effective teaching and learning of sciences.
- School districts and politicians in Nigeria are being urged to get goals of increasing science students' access to computers and internet for effective teaching and learning of sciences.
- Science students should be encouraged to learn in small groups so as to increase emphasis in the broader learning of science.
- The government should be active to her responsibility of providing electricity to schools to enable the computer supported instruction strategy to strive.
- Computer supported collaborative learning is an instructional strategy that teachers should be encouraged to use in the teaching and learning process.

## 6. Conclusion

The purpose of the study was to find out the effectiveness of using instructions based on computer assisted instruction approach on the performance of students. The study has revealed that students exposed to the use of computer assisted instruction obtained higher mean score than students who were taught without computer assisted instruction. It was therefore concluded that teachers should learn to use computer assisted instruction in teaching not only chemical bonding concepts, but also other difficult –to-learn topics in chemistry to the students.

## Compliance with ethical standards

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### *Disclosure of conflict of interest*

No conflict of interest exist between the authors.

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