

EFFECTS OF COMPUTER ASSISTED INSTRUCTION ON SENIOR SECONDARY SCHOOL STUDENT'S LEARNING OUTCOMES IN CHEMISTRY IN EKITI STATE

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ABSTRACT

The study analysed the effects of Computer Assisted Instruction on Senior Secondary Schools performance in Chemistry in Ekiti State. A quasi- experimental design was used for the study. The population for this study comprised of all public senior secondary school students offering chemistry in Ekiti State. The sample for this study was 20 Chemistry students. 1 instrument were used for the study which student's performance in chemistry towards Chemistry. The formulated hypotheses were tested using inferential statistics and t-test. The findings of the study revealed there is significant difference in the performance mean scores of students in experimental and control groups after treatment. There is no significant difference in the post-test mean scores of male and female students in the experimental group. There is no significant difference in the pre-test mean scores of students in experimental and control groups. Hence, based on the findings, appropriate recommendations were made.

Keywords: education, population, computer, assisted, instruction, senior, secondary, school, Ekiti state,

INTRODUCTION

Education encompasses the comprehensive process of human learning, the transmission of knowledge, the cultivation of faculties, and the development of skills. No nation can achieve sustained economic prosperity without significant investment in human capital Science is the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment. It involves formulating hypotheses, designing experiments, collecting and analyzing data, and drawing conclusions based on evidence. (Lawrence 2016). Chemistry is the scientific study of matter and its properties, as well as the transformations that matter undergoes. Chemistry is a central science, as it provides a foundation for understanding many other fields, such as biology, physics, and materials science. Paris and Helmenstine (2020) simply put that chemistry explains the world around us. Knowledge of Chemistry can help students perform well in other

science subjects. Chemistry is one of the compulsory subjects in Nigerian schools. Chemistry is to be offered by all senior secondary school students who are in science class, and to be passed at minimum of credit level. A credit pass in Chemistry has always been a yardstick for most science related courses in our higher institutions of learning and a determinant of choice of course and career option.

Some instructional methods have been adopted by teachers in the teaching of Chemistry, methods like discussion method, lecture method, as well as project method amongst others, which are now being seen as conventional methods. These methods were found not to be yielding the desired result. The conventional methods are deficient in that they lack capacity in motivating students in learning. Some of these methods are teacher-centered and students may feel that they don't have the chance to express their interests and skills. Students taught using conventional methods merely absorb the instructions being passed to them in class. The methods make students become passive learners and the students will have to learn with the pace of their teachers. The conventional methods also make teachers use their authority in making all the decisions concerning the students leaving the students with no room to express themselves (Faletiba, 2019). According to Yap, (2016), those methods often inhibits the ability of learners to think critically and logically. This also makes it difficult for identification of students' area of weakness, which may eventually make students perceive Chemistry as a difficult subject. However, this is not to say that these strategies are now totally irrelevant, because they can still be used to teach some topics in Chemistry and also form the basis for the development of any other strategies that can be used in the teaching and learning of Chemistry (Falebita, 2019). Moreover, Chemistry teachers are not expected to be stereotypic about a particular teaching method. In the opinion of the researcher, when poor teaching strategy is used to teach Chemistry, the subject may appear absurd and abstract to the learners. Thus, it becomes necessary to take a closer look into the teacher's choice of strategies during chemistry classroom interactions. There is need to search for alternative method of instruction for Chemistry teaching and learning which will be effective in bringing about student-centeredness and help students understand what was learnt alongside with their enlisted interest in the subject. Computer-assisted instruction is the use of computers as an interactive instructional technique whereby a computer is used to present the instructional materials and monitor the learning that takes place (Furo, 2015). It uses a combination of two or more of text, graphics, sound and even videos in the process of learning. Children's engagement in learning can be enhanced by incorporating technology in the classroom. Given their familiarity with electronic gadgets, integrating technology into education is likely to capture their interest and increase their level of involvement. By using projectors, computers, and other advanced technical equipment, the classroom experience can become fascinating and entertaining for students, keeping them focused on the subject matter and minimizing distractions.

Computer Assisted Instruction as an educational computer programs could be made available online, in computer memory and/or textbooks. Computer Assisted Instruction could enhance chemistry teachers in passing instructions to the learners, in several ways. It can also allow students to progress at their own pace and work individually or in groups. Computer aided

instruction has been found to enhance students' performance than the conventional instructional methods in counsellor education. When teachers employ exciting, innovative, and reflective approaches, they not only enhance students' understanding but also instill a genuine appreciation for Chemistry, thereby promoting critical thinking (Opatye, 2012). Ugwu (2012) mentioned that conventional teaching techniques often make students passive, leading to underperformance in Chemistry.

In his paper on effective service delivery in pedagogy and its impact on teachers' orientation and attitude towards teaching, Ayodele (2018) highlighted several factors that need to be taken into consideration. Some of these factors include:

The personal interests of prospective teachers

The ability to communicate with enthusiasm

Promotion of E-teaching

Encouragement of team teaching

Practical demonstrations of instructional delivery and

Teachers should endeavor to adopt innovative pedagogical approaches to teaching to enable students to relate their learning to real life experiences.

The utilization of Computer-Assisted Instruction (CAI) offers a range of powerful features that can greatly enhance the learning environment for both educators and students. This implies that embracing CAI has the potential to bring about a positive transformation in the education system and significantly improve the performance of teachers and learners in Nigeria. However, despite the promising outlook of CAI in the teaching and learning process, there are several challenges hindering its adoption in Nigeria. These challenges include insufficient funding for the education sector, a lack of emphasis on maintenance practices, and an unreliable power supply. Some of these obstacles have emerged due to changing socio-economic and political circumstances, while others have resulted from the government's neglect of the education sector (Raimi, 2012; Ojo, 2019).

To overcome these challenges, it is crucial to implement targeted recommendations that can enhance the adoption and utilization of CAI in Nigeria's education system. CAI can provide learners with extended practice, which, in turn, can lead to acquisition of basic skills and encourage better learning of students. According to Adeshina and Hanna (2016), Computer Assisted Instruction (CAI) facilitates rapid learning and empowers students with greater control over their educational journey.

As marked by Jaladanki and Bhattacharya (2014), learning aids have moved from chalkboard to projector transparencies and so to video projectors and PowerPoint. Unlike traditional classrooms, where students are grouped together regardless of their individual differences and class size, computers allow for individual or group access, providing a more personalized learning experience (Laleye, 2019). The impact of gender on science education, particularly in

the field of Chemistry, cannot be overstated. While some researchers, such as Okereke and Onwuekwe (2011), argue that there are gender differences in students' performance in science subjects, others like Aniodoh Andoh and Egbo (2013) have observed no significant differences.

In a study conducted by Bosede (2010) on the influence of gender on the relationship between students' challenges and academic performance, it was confirmed that students' gender do affect their academic achievements in certain subject areas while Akomolafe (2019) concluded in his study that performance shows no notable disparity between genders.

The researcher observed from teaching experience as a classroom teacher that in many public secondary schools in Ekiti State, Chemistry classroom is teacher-centered; making teachers become authoritative in which case, the primary roles of students are to sit, listen, and write what is on the board and then copy series of exercises from the text materials. This situation seems to be the reason why many students lose interest in what is being taught, and become easily disconnected from the process of learning. The researcher is of the opinion that there is a need for more interactive and student-centered approach that can enable the effective teaching and learning of chemistry. It is the researcher's belief that the introduction of Computer Assisted Instruction may resolve these issues by supporting creativity, dynamism, interaction in chemistry classroom and improve the performance of students in Chemistry.

The purpose of the study was to investigate the effects of Computer-Assisted Instruction on Secondary School Students' Learning Outcomes in Chemistry in Ekiti State. The specific objectives are to:

- i. Examine the effects of Computer Assisted Instruction on students' performance in Chemistry;
- ii. examine the influence of student's gender on performance in Chemistry.

The following research question were raised for the study:

1. What are the performance mean scores of students in Chemistry before and after exposing them to computer-assisted instruction (CAI)?

The following null hypotheses was tested at 0.05 level of significance:

1. There is no significant difference in the performance mean scores of students in experimental and control groups before treatment.
2. There is no significant difference in the performance mean scores of students in experimental and control groups after treatment.
3. There is no significant difference in the pre-test and post-test mean scores of male and female students in the experimental group.

Intact class of S.S.S 2 Students from 6 public secondary schools in Ekiti State

Multistage sampling procedure will be used to select the sample for the study

First stage is the use of simple random Sampling technique to select one senatorial District from the three senatorial districts in Ekiti State.

Second stage will be the random selection of three local government areas (LGAs) from the selected senatorial district.

The third stage will be the selection of two schools from each of the selected LGAs using stratified random sampling technique.

This chapter presents the results and discussion of findings. Presentation of data was carried out in two stages. The first stage involved answering of the research questions earlier raised in the study and the second stage covered the testing of hypotheses. Discussion of the findings was presented at the end of the analysis.

Question 1: What is the performance mean score of students in Chemistry before and after being exposed to Computer-Assisted Instruction (CAI)?

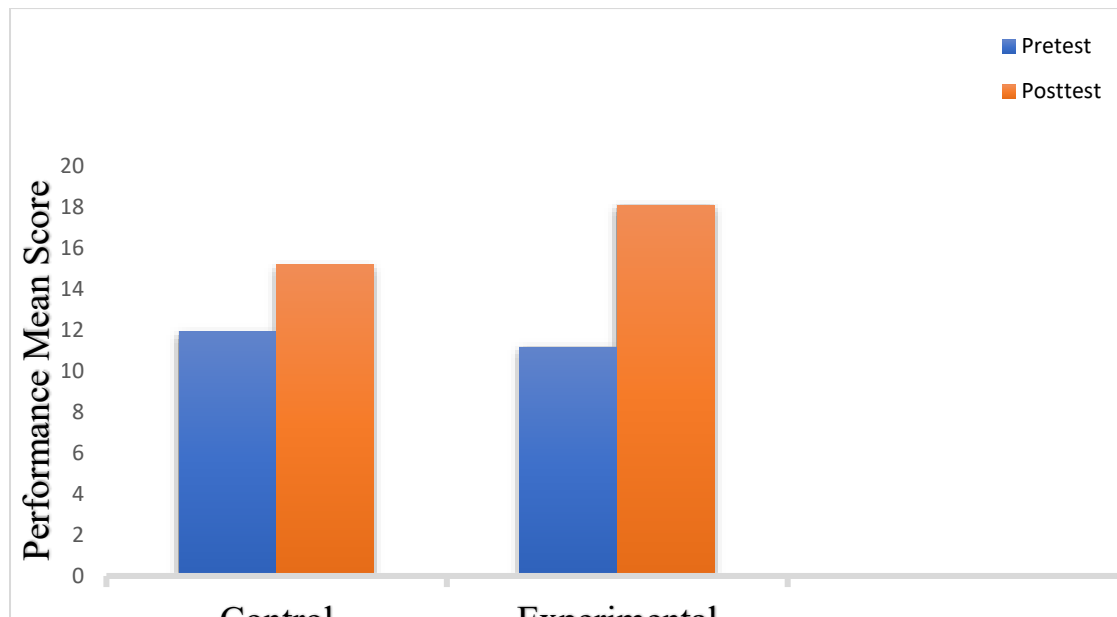
In answering the question, performance mean scores of students exposed to Computer-Assisted Instruction and conventional method of teaching Chemistry before and after treatment were computed and compared. The result is as shown in Table 1 and Figure i.

Table 1: Performance Mean Scores and Standard Deviation of Students in Experimental and Control groups

<i>Group</i>	<i>N</i>	<i>Pretest</i>		<i>Posttest</i>		<i>Mean Difference</i>	<i>Ranking Performance</i>
		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>		
Control	41	11.90	1.885	15.17	1.408	3.27	2 nd
Experimental	36	11.15	2.694	18.07	1.137	6.92	1 st

Information contained in Table 1 shows that, students in the control and experimental groups, had performance mean scores of 11.90 and 11.15 respectively prior to treatment. It appears that the groups are homogenous prior to the treatment. On exposure to treatment, students taught with CAI had the higher performance mean score of 18.07, while those students in the control group had performance mean score of 15.17. This implies that, the use of Computer-Assisted Instruction appears to be more effective than the conventional method in enhancing the performance of students in Chemistry. Students' performance in Chemistry before and after treatment is represented in Figure i.

Figure i: Graphical Representation of Performance Mean Scores of Students in Experimental and Control groups.



Testing of Hypotheses

Hypothesis 1: There is no significant difference in the performance mean scores of students in experimental and control groups before treatment.

To test Hypothesis 1, pre-test mean scores of students in experimental group and those in the control group were computed and compared for statistical significance using t-test at 0.05 level. The result is presented in Table 3.

Table 2: t-test summary of Pre-test Mean Scores of Students in Experimental and Control Groups

Group	N	Mean	SD	df	t_{cal}	P
Control	41	11.90	1.885	75	0.720	0.068
Experimental	36	11.15	2.694			

$p > 0.05$ (Not Significant)

The result in Table 3 shows that ($t_{75} = 0.720$, $p = 0.068 > 0.05$). Since the P-value is greater than 0.05, the hypothesis is not rejected. This implies that, there is no significant difference in the pre-test mean scores of students in experimental and control groups. This shows that the two groups were homogeneous at the commencement of the experiment.

Hypothesis 2: There is no significant difference in the performance mean scores of students in experimental and control groups after treatment.

To test Hypothesis 3, post-test mean scores of students in experimental and control groups were computed and compared for statistical significance using t-test at 0.05 level. The result is presented in Table 5.

Table 3: t-test summary of Post-Attitudinal Mean Scores of Students in Experimental and Control Groups

<i>Group</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t_{cal}</i>	<i>P</i>
<i>Control</i>	41	15.17	1.408	75	5.364	.000
<i>Experimental</i>	36	18.07	1.137			

**p<0.05 (Significant result)*

The result in Table 4 shows that ($t_{75} = 5.364$, $p = 0.000 < 0.05$). Since the *P-value* is less than 0.05, the hypothesis is thus rejected. This implies that, there is significant difference in the performance mean scores of students in experimental and control groups after treatment. The mean score in the table shows that the students in the experimental group perform better than those in the control group.

Hypothesis 3: There is no significant difference in the post-test mean scores of male and female students in the experimental group.

To test Hypothesis 3, post-test mean scores of male and female students in the experimental group were computed and compared for statistical significance using t-test at 0.05 level. The result is presented in Table 7.

Table 5: t-test summary of Post-Test Mean Scores of Male and Female Students in Experimental Group

<i>Group</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t_{cal}</i>	<i>P</i>
<i>Male</i>	20	11.10	2.954	34	0.105	0.204
<i>Female</i>	16	11.00	2.535			

p>0.05 (Not Significant result)

The result in Table 5 shows that ($t_{34} = 0.105$, $p = 0.204 > 0.05$). Since the *P-value* is greater than 0.05, the hypothesis is thus not rejected. This implies that, there is no significant difference in the post-test mean scores of male and female students in the experimental group.

Discussion

The study's results indicated that both the control and experimental groups had similar low performance levels in the pretest. This suggests that both groups had an equivalent knowledge base before the experiment began. As a result, any notable differences observed later can be attributed to the specific interventions applied, rather than mere chance.

It was recorded that both groups' mean scores were low, which the researcher believes might be linked to the general ineffectiveness of the traditional teaching methods often used in science classes, including Chemistry. Such methods might not sufficiently address students' learning challenges in Chemistry. Supporting this view, Ugwu (2012) mentioned that conventional teaching techniques often make students passive, leading to underperformance in Chemistry. Jaladanki and Bhattacharya (2014) noted a shift in teaching aids from chalkboards to transparencies and then to video projectors and PowerPoint presentations. Opataye (2012) stated that when educators use innovative and reflective methods, they not only deepen student comprehension but also foster a true appreciation for Chemistry, encouraging critical thinking.

Another pivotal observation from this study was the significant difference in performance scores between the experimental and control groups post-intervention. This suggests that computer-assisted instruction was more potent in boosting students' Chemistry performance than traditional teaching methods. This aligns with Adesina and Hanna (2016), who noted that computer-assisted instruction accelerates learning and grants students more agency in their educational experience. Separate studies by Ayodele (2018) and Ugwu (2012) also indicated that blending computer-assisted instruction with conventional methods enhances teaching effectiveness and subsequently improves students' learning outcomes in Chemistry.

The results of this study indicated that there was no notable difference in the performance mean scores of students between the experimental and control groups prior to the treatment. This suggests that the two groups were comparable in terms of their performance towards Chemistry before the treatment was introduced.

In conclusion, the research indicated that there is no notable difference in the post-test mean scores between male and female students within both the experimental and control groups. This suggests that a student's gender doesn't significantly affect the efficacy of the instructional method used. The outcomes for male and female students under computer-assisted instruction were largely similar. Similarly, when exposed to traditional teaching methods, the results for both genders were comparable. Therefore, female Chemistry students performed on par with their male peers in all groups studied. The finding aligns with Bosede's (2010) assertion that gender does not play a significant role in influencing students' performance in science subjects. Similarly, both Kissan (2016) and Akomolafe (2019) concluded in their study that performance shows no notable disparity between genders.

Recommendation

Based on the findings of this study, the following recommendations were made:

1. Conventional method of instruction presently used by Chemistry teachers should be improved upon and modified by incorporating computer assisted instruction into the teaching and learning process to foster meaningful learning experiences for students;
2. Teachers of Chemistry in secondary schools should embrace the utilization of computer assisted instruction;

3. To boost chemistry understanding and encourage students to actively engage in constructing their own insights, teachers should employ the CAI teaching method;

Contribution to Knowledge

The study investigated the effects of computer assisted instruction on senior secondary school students learning outcomes in chemistry in Ekiti State. The study highlighted the shortcomings of conventional method of teaching Chemistry and how it can be improved on with the introduction of computer assisted instruction in the teaching and learning of Chemistry in the classroom. Findings from the study has contributed to knowledge in the following ways:

1. The use of computer assisted instruction has positively changed students' attitudes towards Chemistry as well as teachers' teaching methods.
2. The study allows for the customization of content based on the student's individual needs, preferences, and performance. This means students can progress at their own pace, reviewing materials they find challenging and moving quickly through content they grasp easily.
3. The study provides instant feedback on students' performance, allowing learners to understand their mistakes and make corrections in real time.

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