

EFFECT OF COMPUTER ASSISTED INSTRUCTIONS ON STUDENTS' PERFORMANCE AND RETENTION IN CHEMISTRY AMONG SENIOR SECONDARY SCHOOLS IN KATSINA STATE, NIGERIA.

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Abstract

The study examined the Effect of Computer Assisted Instruction on Students' Performance and Retention in Chemistry among Senior Secondary Schools in Katsina state, Nigeria. Four research objectives, four research questions and four research hypotheses were developed. The study adopted Quasi-experimental and control group design. The population of the study comprised of 14,602 students from 24 public secondary schools in Katsina Zonal Education Quality Assurance. Two schools were sampled based on cluster. Intact classes were used in each school with a sample size of 113 students. *The instrument for data collection was Chemistry Performance Test (CPT) which was validated by 2 senior lecturers in the Department of Chemistry and Education.* The reliability coefficient of the CPT was obtained using PPMC which was 0.76. The Research questions were answered using mean and standard deviation, while null hypotheses were tested at 5% level of significance using t-test independent sample. The major findings revealed there was a significant difference in the mean performance and retention between experimental and control group in favor of experimental group, it was concluded that the students taught Chemistry using computer assisted instructions perform better than those taught using lecture method. The study recommended among others that since computer assisted instruction enhanced students' performance, it should be emphasized in the curriculum of Chemistry teaching process.

Keywords: *Computer Assisted Instructions, performance, retention, chemistry.*

Background to the Study

The importance of science and technology to individual lives as well as to the progress of those fields for the benefit of humanity and society at large cannot be overstated. One can acquire scientific literacy through science education, which is necessary for both economic survival and scientific and technological advancement. According to Akpan (2008), the nations in the forefront of contemporary progress are those that have committed large resources over a long period of time to the establishment and maintenance of a stable, well-supported science and technology education.

Chemistry is the study of the structure, composition, characteristics, and transformations of matter (Ojokuku, 2010). Chemistry is a branch of science that study the properties of matter in terms of its compositions, structures, transformations, interactions, and energy implications, according to Science Teachers Association of Nigeria (STAN. 2016). The structure, properties, and uses of matter can also be characterized as aspects of chemistry, as can the variations that

material experiences as a result of molecular changes. Chemistry is a field of study that thoroughly examines the constituents, characteristics, and purposes of both organic and inorganic substances in addition to a number of fundamental forms of matter (Nnoloi, 2011). Despite the importance of chemistry in our educational system and the efforts made by researchers to improve performance, student performance in chemistry is still low. The failure has been attributed to a variety of things, including the improper use of instructional approaches in the teaching of chemistry, teachers who lack subject-matter expertise, a lack of instructional materials, inadequate labs, a failure to cover the curriculum, shady examination practices, class size, and a lack of time for conducting practical, among others. Poor teaching strategies are therefore one of the key reasons why students perform below average in chemistry. In view of the aforementioned issues, it is now imperative to find a solution to the low academic performance of chemistry students. Nnaka (2006) suggests a modification in the way science, technology, and mathematics (STM) are taught, moving beyond the traditional methods.

Computer-Assisted Instruction (CAI) is a method of teaching that makes use of digital tools and computer technology. When teaching CAI, the instructor typically creates software utilizing a specific subject, such as chemical bonding in chemistry. The topics that students in CAI classes are required to acquire are adequately explained to them, and they always progress at their own rate. According to Serkan (2015), drill-and-practice tutorial or simulation activities were also frequently referred to as CAI. These activities are frequently used by students to learn in addition to conventional, teacher-led education. A computer software package is applied to the educational process in computer-assisted instruction (Kulik & Kulik, 1991). According to him, computer assisted instruction (CAI) education and training is one of the most promising methods for disseminating digital knowledge, and schools stand to benefit much from it. Reduced travel expenses, just-in-time learning, and improved retention due to tailored learning are just a few of the potential advantages. However, there are certain unique design considerations when delivering Computer-Assisted Instruction (CAI). The most crucial of these issues is choosing a delivery method or a combination of methods. There are two types of CAI delivery methods: cooperative computer-assisted instruction (CCAI) and individualized computer-assisted instruction (ICAI). In ICAI one Computer is given to one student while in CCAI, a minimum of two students and a maximum of four students are given one Computer to learn with. In this study the ICAI category was adopted.

Retention is the ability to store what has been learnt and recall what has been stored in the memory. According to Bichi, (2012) retention is the ability to retain and later remember information or knowledge gained after learning in to memory. The nature of the materials to be coded contributes to the level of retention. Teaching methodologies contribute to quality and level of retention in terms of meaningful, concreteness and image evolving characteristic (Adeniyi, 2017).

Statement of the Problem

One of the fundamental and essential sciences that aim to equip students with the knowledge and abilities of pertinent scientific concepts and procedures is chemistry. Despite the importance of chemistry in the school science curriculum, students' results in chemistry

examinations for the senior secondary school certificate have been less than impressive over the years as their performance has fluctuated.

Students were observed to have trouble drawing the structures of chemical compounds and routinely do poorly in the West Africa Examinations Council (WAEC) Chief Examiners' report (CER, 2015). Additionally, it was stated in the chief examiners report of WAEC (2020) that pupils have deficiencies while responding to questions about chemical bonding and hybridization. Additionally, it was found that candidates typically did not tackle questions on chemical bonding correctly, which contributed to their subpar results. These flaws can be linked to pupils' inadequate knowledge and comprehension, which may result from bad chemistry instruction. According to Yusuf (2009), the lecture approach used to teach Chemistry lessons, poor perception, a lack of interest, a bad attitude, and an inadequately equipped lab contributed to the poor students' performance and retention in the subject. Poor teaching practices are the main cause of students' failure in chemistry among these issues.

The widespread adoption of Computer-Assisted Instruction (CAI), one of the most recent techniques to learning, served as another impetus for the current study. According to Hoare (2008), CAI is a major shift in how people are taught. He added that schools that do not adopt this technological advancement in education will not be able to meet the needs of digital, knowledge-based society on a global scale and will, as a result, not survive the shift in the paradigm of education. Since education is a global good, Nigeria must adopt the CAI, which is the current international trend.

Objectives of the Study

The specific objectives of the study are to:

1. Identify the effect of Computer Assisted Instructions on students' performance in Chemistry among senior secondary schools in Katsina State Nigeria.
2. Examine the effect of Computer Assisted Instructions on students' retention in Chemistry among senior secondary schools in Katsina State Nigeria.
3. Identify the difference between the performance of male and female students in Chemistry taught using Computer Assisted Instructions.
4. Find out the difference between the retention of male and female students in Chemistry taught using Computer Assisted Instructions.

Research Question

This study is out to investigate Effect of CAI on Students' Performance and Retention in Chemistry among Senior Secondary Schools in Katsina state, Nigeria. Therefore, the study would attempt to answer the following Research questions, which are;

1. What is the effect of Computer Assisted Instructions on students' performance in Chemistry among Senior Secondary Schools in Katsina State Nigeria?
2. What is the effect of Computer Assisted Instructions on students' retention in Chemistry among senior secondary schools in Katsina State Nigeria?

3. What is the difference in the performance of male and female Chemistry students taught using Computer Assisted Instructions?
4. What is the difference between the retention of male and female Chemistry students taught using Computer Assisted Instructions?

Research Hypotheses

The following null hypotheses guided the study:

H₀₁: There is no significant difference in the mean score between the performance of Chemistry students' taught Chemistry using computer assisted instructions and those taught using lecture method.

H₀₂: There is no significant difference in the mean score between the retention of Chemistry students' taught chemistry using computer assisted instructions and those taught using lecture method.

H₀₃: There is no significant difference in the mean score between the performance of male and female students taught Chemistry using computer assisted instructions. **H₀₄:** There is no significant difference in the mean score between the retention of male and female Chemistry students taught using constructive computer assisted instructions.

Methodology

The study used Quasi-experimental and control group design using pretest, posttest and post post-test to examine the impact of computer-assisted instruction on students' performance and retention in chemistry among senior secondary schools in Katsina state, Nigeria. However, it is a pre-test, post-test and post posttest design. In this design, intact classes were used for the study, so there is nonrandomization of the subjects

The population of this study consisted of all SS2 public senior secondary school chemistry student in Katsina Zonal Education Quality Assurance, Katsina State for 2022/2023 academic session. There is a total of 24 Public Senior Secondary Schools in various locations of the zone. These gave a total population size of 14,602 (Source; Katsina Zonal Education Quality Assurance, 2023). The choice of SS2 students is based from the fact that they are much more settled and have spent sufficient time in terms of coverage of the syllabus.

Simple random sampling technique and cluster sampling were both used to choose samples. All the schools in the three local government areas that make up the zone were drawn and divided into two clusters using the cluster sampling technique. The selection of one school from each cluster likewise followed a simple random sampling technique. SEOSSS Kamarawa and Govt. Day Sec. Sch. Natsinta (Jibia) were chosen as the study's schools, and they were pretested as the experimental and control groups, respectively. A total of 113 students from two intact classrooms (one from the experimental group and one from the control group) were employed in the study.

Chemistry Performance Test was the instrument the researcher utilized. Twenty (40) multiplechoice questions from the SS2 syllabus were adapted for the test from previous WASSCE and NECO (2018, 2019 & 2020) multiple-choice questions. The researcher decided on this

subject because it is one of the first topics covered in chemistry. The instrument was validated by two senior lecturers in the Department of Chemistry and the Department of Science and Vocational Education. The tool has proved itself to be useful to the researcher in determining the impact of computer-assisted instructions in science teaching, particularly in Chemistry.

Results

All the 4 research hypotheses in this study were tested using, Statistic Package for Social Sciences (SPSS) v.23.0. In order to be able to test the stated hypotheses, the researcher made use of inferential statistics. Independent samples t-test statistic was used. The use of this statistic was based on the fact that the data collected was continuous in nature. Therefore, and all the hypotheses were tested at 5% level of significance.

Table 1: t-test Analysis of Performance Score between Experimental Group and Control Group

Groups	N	Mean	Std. Dev.	Df	t value	P value	Remark
Experimental	53	25.55	4.80	111	16.44	.00	Rejected
Control	60	12.55	3.10				

From Table 1, the difference in the mean performance between those taught Chemistry using computer assisted instruction and those taught using lecture method, among senior secondary schools in Katsina state Nigeria was ($t = 16.44$, $df = 111$, and $P = .000$). Since the p-value (.000) is less than the alpha value (.05), the null hypothesis is hereby rejected and the alternate hypothesis was adopted. So, the researcher concluded that there is a significant difference in the mean performance between those taught Chemistry using computer assisted instruction and those taught using lecture method, among senior secondary schools in Katsina state Nigeria, in favour of students in the Experimental group, who were taught Chemistry using computer assisted instruction.

Table 1: t-test Analysis of Retention Ability between Experimental and Control Group

Groups	N	Mean	Std. Dev.	Df	t value	P value	Remark
Experimental	53	26.07	4.47	111	17.86	.00	Rejected
Control	60	12.11	3.33				

From table 2, the difference in the mean retention ability between those taught Chemistry using computer assisted instruction and those taught using lecture method, among senior secondary schools in Katsina state Nigeria was ($t = 17.86$, $df = 111$, and $P = .000$). Now since the p-value (.000) is less than the alpha value (.05), the null hypothesis is hereby rejected and the alternate hypothesis was adopted. So, the researcher concluded that there is a significant difference in the mean retention ability between those taught Chemistry using computer assisted instruction and

those taught using lecture method, among senior secondary schools in Katsina state Nigeria, in favour of students in the Experimental group, who were taught Chemistry using computer assisted instruction.

Table 3: t-test Analysis of Performance Score between Male and Female Students

<u>Groups</u>	<u>N</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>df</u>	<u>t value</u>	<u>P value</u>	<u>Remark</u>
Male	30	25.80	5.33	51	.42	.66	Retained
Female	23	25.13	3.92				

From the Table 3, the difference in the mean academic performance between male and female students taught Chemistry using computer assisted instruction, among senior secondary schools in Katsina state Nigeria was ($t = .420$, $df = 51$, and $P = .66$). Now since the p-value (.66) is greater than the alpha value (.05), the null hypothesis is hereby retained. So, the researcher concluded that there is no significant difference in the mean performance between male and female students taught Chemistry using computer assisted instruction, among senior secondary schools in Katsina state Nigeria.

Table 4: t-test Analysis of Retention Ability between Male and Female Students

<u>Groups</u>	<u>N</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>df</u>	<u>t value</u>	<u>P value</u>	<u>Remark</u>
Male	30	25.44	4.95	51	1.16	.25	Retained
Female	23	27.13	3.44				

From table 4, the difference in the mean retention ability between male and female students taught Chemistry using computer assisted instruction, among senior secondary schools in Katsina state Nigeria was ($t = 1.16$, $df = 51$, and $P = .25$). Now since the p-value (.25) is greater than the alpha value (.05), the null hypothesis is hereby retained. So, the researcher concluded that there is no significant difference in the mean retention ability between male and female students taught Chemistry using computer assisted instruction, among senior secondary schools in Katsina state Nigeria.

Summary of the Findings

From the result presented in this study, the summary of the major findings is that there was a significant difference in the mean performance and retention ability between those taught Chemistry using computer assisted instruction and those taught using lecture method in favour of students in the Experimental group. Also, that there was no significant difference in the mean performance and retention ability between male and female students taught Chemistry using computer assisted instruction

Discussions of the Findings

From the results above, it was clear that there was a significant difference in the mean performance and retention between those taught Chemistry using computer assisted instruction and those taught using lecture method, among senior secondary schools in Katsina state Nigeria, in favor of students in the Experimental group, who were taught Chemistry computer assisted instruction. This finding agreed with that of Yusuf & Afolabi (2010) that using computer assisted instruction teaching approach significantly enhances students' performance in Chemistry.

In all these findings of Reid (2008), Kingsley (2009) and Kulik & Kulik (1991), indicated that computer assisted instruction enhanced the efficacy of teaching and provide students with adaptive environment which enable them to learn what they need. This is so because, in a computer assisted instruction environment, students are encouraged for free expression, collaboration and exchange of ideas with their peers. Also, in the process of utilizing hints, students strive to transform experiences into information meaningful which can lead them to achieve the desired goal.

Again, from the finding, it was discovered that there was no significant difference in the mean performance and retention between male and female students taught Chemistry using computer assisted instruction, among senior secondary schools in Katsina state Nigeria. This implies that both male and female students taught using computer assisted instruction performed at almost the same pace. This finding agrees with that of Hassan and Usman (2013), who discovered that computer assisted instructions are gender friendly.

Conclusion

Based on the analyses in this work, the researcher concluded that there was a significant difference in the mean performance and retention those taught Chemistry using computer assisted instruction and those taught using lecture method, among senior secondary schools in Katsina state Nigeria, in favour of students in the Experimental group, who were taught Chemistry using computer assisted instruction. Also, it can be concluded that the computer assisted instruction is gender friendly in terms of enhancing performance and retention, and gender biased, in favour of male students.

Recommendations

Based on the findings of this study, the following are hereby recommended;

1. Since computer assisted instruction enhanced students' performance, it should be emphasized in the curriculum of Chemistry teaching / learning process.
2. Since computer assisted instruction enhanced students' retention ability, it is recommended that Chemistry teachers should continuously use computer packages in teaching chemistry as it guarantees improvement in students' performance in chemistry.
3. Since computer assisted instruction have significant impact in the performance, retention of Chemistry students; therefore, it is recommended that Government, PTA and NGO should develop relevant Computer-Assisted Instructional packages for teaching chemistry in Nigerian Secondary Schools.

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