Effect of Computer-Aided Instruction on Junior Secondary Students' Achievement and Retention in Basic Science in Ado Local Government Area of Ekiti State, Nigeria.

[1]OGUNYEBI, [2]TUNJI HENRY (Ph. D)

Department of Science Education,
Bamidele Olumilua University of Education,
Science and Technology, Ikere- Ekiti, Nigeria.

Abstract- **This study aimed at finding out the effects of computer-aided instruction on junior secondary students' achievement and retention in basic science in Ado local government area of Ekiti State, Nigeria. The study utilized a non-randomized pretest post-test quasi-experimental design. The population for this study consisted of all JS II students in secondary schools in Ado Local Government Area. The sample for this study was made up of 120 JS II basic science students drawn from four sampled junior secondary schools. Multi-stage sampling procedures was used in selecting sample for this study. . Thirty students were selected from each school taken cognizance of equal representation of samples in the target population. Basic science Achievement and Retention Test (BSART) developed by the researcher was the instrument for data collection. The Basic Science Achievement and Retention Test (BSART) was used to teststudents' achievement and retention in basic science. The instrument, BSART was validated by 2 specialists in scienceeducation at the Bamidele Olumilua University, Ikere-Ekiti and the general criticisms and suggestions were used for improving the instrument. The data collected from the twogroups were analyzed using Kuder Richardson's (KR_{21}) formula to establish the reliability coefficient of the instrument. This instrument gave a reliability coefficient (r) of 0.78. The data collected from Basic Science Achievement and Retention Test were presented and analyzed using the ANCOVA to test the hypotheses at 0.05 level of significance. Based on the findings of this research, it was concluded that computer-aided instruction in basic science enhances achievement and retention of the junior secondary students. On the basis of findings from this study, it was recommended among others that: Computer literacy programme should be provided for both students and teachers for full integration of ICT resources in Science Education Programme. Government, Non-Governmental Organization and Parents Teacher Associations should fund development of CAI packages in the schools, equip the schools with necessary ICT facilities and train manpower to produce software for science education in Nigerian**

Key words: **Computer-Aided Instruction, Basic Science, Achievement, Retention**

INTRODUCTION

It is impossible to overstate how crucial science and technology are to a nation's development. This is due to the fact that the advancement of any society depends greatly on its citizens' knowledge and technical skills. Citizens who are able to comprehend and contribute to shaping the complicated effects of science and technology on our world will determine the course of our society in the future (Ungar, 2010). As a result, Nigeria's educational policies and programs are focused on the sciences and basic science as the core and foundation of science, which serves as the pivot around which other Science subjects revolve.

For the understanding of the many challenges facing contemporary society, including new technologies and sustainable development, it is essential to comprehend the content and processes studied by science (Zdem, 2010). Science and technology are the source of every manufactured item you see in your home or place of business. For instance, science and technology are products of mobile phones, radio and television sets, PC tablets, iPads, iPhones, iPods, laptops, and desktops among other devices.(Tunde and Anthony, 2010). Given these contributions, Ashike (2012) suggested that action be taken to ensure that Nigerian citizens are well-trained in science and technology for the nation's advancement in those fields. Patrick (2011) defines "Computer assisted instruction (CAI) as the use of computers and software applications to teach concepts or skills." Similarly the concept of computer assisted learning (CAL) is adjacent with CAI which means use of elements regarding information and communication technology which assist within an educational setting. Types of program may include tutorials,simulation, game, modeling, different general and specific purpose packages. Usage of this mode will enhance both cognitive and social gains.
Research has shown that children with learning disabilities also benefit from CAI in terms of comprehension skills, according to Stetter (2011). Through specific strategies designed for these skills, students receive assistance with visual imaging, advance organizers, summation, and self-questioning. The majority of students enjoy using computers without any special assistance. In his description of the function of computers as machines, Mark (2010) asserts that the idea of R2 and D2 robots, as well as the claim that computers will replace tutors, remain alarming in light of predictions for the future. Computers make it easier to teach and learn regardless of race, class, or individual abilities. Thus, the student's confidence rises and his or her social awkwardness declines. Mark adds that because they are sophisticated machines, computers have some limitations. A working understanding is crucial for a teacher to be competent in computer-related work.

Teachers use computers in a variety of ways. Some believe they have been forced into fields in which they lack experience, and as a result, they view this practice as hostile. Computer-aided instruction involves the use of computers to supplement classroom instruction. Computer-aided instruction does not fully replace the teacher in a classroom environment. The computer is simply an electronic device or machine that accepts data, processes data and gives out output with great speed and accuracy. Computer-aided instruction uses a combination of texts, graphics, sound and videos in the learning process. The outcome of a test or examination is achievement. Ash (2005) discovered this when assessing the students' progress using computer-aided instruction.

Computer aided instruction programs improved students' academic performance in some ways. Kingsley and Boone's (2008) study found that students who used computers in addition to textbooks for instruction performed better on a national assessment. A computer-aided strategy could present science in an active, data-based format and enable both students and teachers to actively participate in the teaching-learning process. This might lessen the long-standing stigma associated with the chalk-and-talk method of science instruction. As the growth of educational programs continues to rapidly accelerate, concern over the retention of the students' knowledge is increasing. Retention is the ability of a student to hold and bring to mind a memory of the previously learned skills, knowledge and experienceduring and after examination. Retention is significantly important, not just for student success, but also for the success of academic institutions. Nnaobi (2013) found that computer-aided instruction has the ability to sustain students' interest, encourage them to participate actively in the lesson and retain concepts learnt for a long time.

However, while the Nigerian Educational Research and Development Council (NERDC, 2007) advocates the use of activity-based and guided inquiry approaches in basic science education, the adoption and application of these approaches remains difficult due to the lack of textbooks. Science teachers reluctant to improvise local alternatives to improve teaching. Therefore, teachers enter the classroom with a body of one-way communication and resort to traditional teaching methods.

Nevertheless, the Nigerian Educational Research and Development Council (NERDC, 2007) advocates the use of activity-based and guided inquiry approaches to basic science teaching, but the adoption and application of these methods are still an illusion because of paucity of instructional materials and unwillingness of the science teachers to improvise alternative materials locally to improve instructional delivery. Consequently,teachers resort to conventional lecture method, walk into the classroom with a keypoint text for one-way communication; and copy a few points on the chalkboard. Lessons are rarely been planned and instructional materials are hardly been used by these teachers. This explains the choice of conventional lecture method as the control variable to expose its ineffectiveness in delivering basic science concepts; and to provide a way forwardthat suggests the use of computer-aided instruction that combines activity-based and inquiry approaches to science teaching. Another reason for the choice of computer-aided instruction and lecture methods is not just for mere comparison of the two methods but to create awareness among the junior secondary school teachers that there is a paradigm shift from conventional lecture method to an enhanced teaching strategy referred to as computer-aided instruction that may minimize the achievement and retention gaps in science education.

Computer-Aided Instruction as an Effective Teaching Method

Not as a replacement for other activities but as an additional tool, computer-aided instruction plays an important part in classroom and laboratory work. Cuoco and Goldenberg (2010) discovered that CAI provided the learner with the opportunity to play with concepts in order to visualize results in a mathematics curriculum. The researchers continued by saying that students who could independently manipulate formulas, variables, and models using a CAI-based tool acquired a better working knowledge of concepts than students who were only exposed to the same concepts through lectures. He proved that CAI, when it involves the synergy of various senses, increases learner knowledge. This suggests that when the curriculum is presented using a mix of text, sound, graphics, and video formats, learners would retain new information better.

The facilitation of critical thinking and the promotion of enriched learning require interactions between instructors and students as well as peer interactions between students. CAI has the significant benefit of necessitating active student participation in the learning process, which is a key benefit of the method. The majority of the time, the student must use the computer's peripheral hardware (e.g. (Scott, 2007) Devices with specialized designs, such as a joystick, keyboard, mouse, or others.

The impact of a computer-assisted instruction (CAI) package on senior secondary students' algebra performance in Anambra State, Nigeria, was examined by Ada, Chinyelu, Anyachebelu, and Anemelu in 2012. The study looked at the significance of students who were taught using traditional methods and computer-assisted instruction in terms of retention and achievement scores. Forty senior secondary school students from two secondary schools made up the sample. 40 students (20 males and 20 females) were chosen using stratified random sampling.

Three research questions and three hypotheses were formulated, and tested at 0.05 level significance. The Algebra Achievement Test (AAT) was made of 50 items of multiple-choice objective type, developed and validated for data collection. The Algebra achievementTest (AAT) was administered to students as pre-test and post-test. The results of students were analyzed using t-test statistic to test the hypotheses. The result indicated that students taught using (CAI) package performed significantly better than their counterparts taught using the conventional method of instruction. Students taught using CAI performed better than the control group in retention test. Also there was no significant difference in the post-test performance scores of male and female students taught using CAI package. Based on the findings it was recommended that Computer-Assistant Program should be encouraged for teaching and learning of Mathematics.

The findings of Yusuf (2010) who found and reported that there was significant difference in the performance of students taught by CAI and LM supported the above finding, the result is in contrast to the previous finding of Bayraktar (2008) who could not found any significant difference between the students exposed to CAI and those exposed to lecture method. The reason for the enhanced achievement of the experimental method could be that the students were stimulated to learn by the use of computer-aided instruction

which spawnsinterest, excitement, total involvement in teaching and learning process, and encourage students to work at their own pace. The result of this study supported the earlier finding of Mudasiru and Adedeji (2010)who found that the performance of students exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction.

Majub (2013) compared the effects of computer-assisted education (CAI) on the performance of middle school students (JHS II) in pre-competence skills after exposure to CBT and traditional instructional methods. The rationale behind this study is that people learn many things better through computer games or multimedia constructs than through traditional methods of direct content delivery. Fifty-nine out of 386 students from two schools in Kumasi Metropolis, Ghana participated in the study. 28 students made up the CAI group and 31 made up the traditional group. Quasi-experimental design was used for the study. Structured pre-test and post-test achievement test with a reliability co-efficient = 0.74 and 0.75 respectively were used to collect data. The study utilized 4 hypotheses which were analyzed using Predictive Analysis Software (PAS) version 18. The study revealed that the CAI group performed better than thetraditional method of instruction group. However, there was no statistically significant difference between the achievements levels of the two groups. It was recommended that CAI should be introduced in the teaching of Pre-Technical skills throughout the country. This study intends to find out the effects of CAI on students achievement and retention in Basic Science.

Statement of the Problem

Instructional strategies and cognitive factors have been identified majorly as being responsible for poor achievement and retention in the sciences. Factors such as absence of computers and software packages, fluctuating internet connectivity, arbitrary charges on data bundles, epileptic power supply, computer illiterate teachers and students and gender are hindrances to the use of computer in schools. Consequently, computer-aided instruction could be an adequate strategy in teaching and learning of basic science. The problem of this study therefore, is to explore the possibility of improving learning outcomes (achievement and retention) using computer-aided instruction

Purpose of the Study

The purpose of this study was to investigate the effect of computer-aided instruction on junior secondary basic science students' achievement and retention. It would aim at the following objectives:

1. To find out if the use of computer in teaching basic science enhances students' achievement in the subject better than the modified lecture method.
2. To determine whether students' retention in basic science is improved by the use of computer-aided instruction when compared with modified lecture method.

Research Questions

The following research questions guided the study:

1. What is the difference in the mean achievement scores of the students taught using computer-aided instruction and those taught using modified lecture method in basic science?
2. What is the difference in the mean retention scores of the students taught using computer-aided instruction and those taught using lecture method in basic science?

Hypotheses

This study was guided by the following null hypotheses which were tested at 0.05 level of significance:

Ho_1. There is no significant difference in the mean achievement scores of students taught using computer-aided instruction and those taught using modified lecture method.

Ho_2. There is no significant difference in the mean retention scores of students taught usingcomputer-aided instruction and those taught using lecture method.

Methodology

The study utilized a non-randomized pretest post-test quasi-experimental design. Hence, only one of the groups will receive treatment. The independent variables and the dependent variables were crossed to provide the basis for 2 x 2 factorial analyses. The research was conducted in Ado Local Government Area of Ekiti State, Nigeria

The population for this study consisted of all JS II students in secondary schools in Ado Local Government Area. This was arrived at by summing the number of the JS II students in junior secondary schools in the study LGA. The choice of JS II students is based on the fact that they are not preparing for an external examination at this level. The students are also expected to have been exposed to basic science concepts at the JS I and II levels to give them a rich knowledge of the subject.

The sample for this study was made up of 120 JS II basic science students drawn from the four sampled junior secondary schools. Multi-stage sampling technique was used in selecting sample for this study. This was used because stratification was done along more than one variable at a time. For instance, purposive sampling was used in selecting schools and random sampling was used in selecting students. The nature of the study, however, requires that the sampled schools were purposely selected. In purposive sampling according to Emaikwu, (2013), specific elements which satisfy some predetermined criteria are selected. A research on CAI must necessarily be conducted in schools where computers are available for students' use. This was why two schools that have computers were selected for experimental group while two schools that have no computers were used as control group. Thirty students were selected from each school taken cognizance of equal representation of samples in the target population.

Basic science Achievement and Retention Test (BSART) developed by the researcher was the instrument for data collection. The Basic Science Achievement and Retention Test (BSART) was used to teststudents' achievement and retention in basic science. The test was developed by the researcher based on the concepts of work, energy, power and kinetic energy taught. The BSART was used to generate data on three occasions during the study, namely during pretest, posttest and post-posttest to determine the achievement and retention of the students in basic science before and after the administration of the treatment.

The instrument, BSART was validated by 2 specialists in scienceeducation at the Bamidele Olumilua University, Ikere- Ekiti and the general criticisms and suggestions were used for improving the instrument. The researcher carried out a pilot study in order to test the reliability of the research instrument. The schools selected for the pilot study did not form part of the main study. These schools were randomly divided into two, experimental and control groups.The data collected from these twogroups were analyzed using Kuder Richardson's (KR_{21}) formula to establish the reliability coefficient of the instrument. This instrument gave a reliability coefficient (r) of 0.78. The data collected from Basic Science Achievement and Retention Test were presented and analyzed using mean and standard deviation to answer research questions, while the ANCOVA was used to test the hypotheses at 0.05 level of significance.

Testing of Hypotheses

Hypothesis 1

There is no significant difference in the mean achievement scores of students taught using computer-aided instruction and those taught by traditional lecture method.

Table 1: ANCOVA Test of Students' Achievement Scores in CAI and LM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	866.16[a]	2	433.08	43.31	.00
Intercept	2182.76	1	2182.76	218.37	.00
Pretest	7.48	1	7.48	.75	.39
Method	**863.07**	**1**	**863.07**	**86.32**	**.00**
Error	1169.84	117	9.99		
Total	55757.00	120			
Corrected Total	2035.99	119			

a. R Squared = .43 (Adjusted R Squared = .42)
* denotes F is significant at 0.05 alpha level.

Table 1 showed one-way ANCOVA test of basic science students' achievement scores in computer-aided instruction and lecture method. Pretest scores were used as covariate to control the initial difference in the two methods. The result from the table 1 revealed that $F_{1,119} = 86.32$, and $p = 0.00$ for the main treatment. The significant value p-value (0.00) was less than the set significant value of the study ($p < 0.05$). Therefore, the null hypothesis that stated that there is no significant difference in the mean achievement scores of students taught using computer-aided instruction and those taught by conventional method was rejected.

The conclusion drawn was that there exists a significant difference in the achievement of basic science students exposed to computer-aided instruction and lecture method. This indicates that there is statistically significant difference between the mean achievement scores of the experimental and the control methods. The experimental group exposed to CAI achieved better than the control group taught using modified lecture method since the estimated effect size of ANCOVA test was considered significant. This suggests the need to deviate from conventional method to computer-aided instruction in order to adjust in line with the paradigmshift in science education pedagogy.

Hypothesis 2

There is no significant difference in the mean retention scores of students taughtusing computer-aided instruction and those taught using lecture method.

Table 2: ANCOVA Test of Students' Retention Scores in CAI and LM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1320.62[a]	2	660.31	49.07	.00
Intercept	497.22	1	497.22	36.95	.00
Posttest	173.61	1	173.61	12.90	.00
Treatment	**295.74**	**1**	**295.74**	**21.98**	**.00**

Error	1574.31	117	13.46
Total	61107.00	120	
Corrected Total	2894.93	119	

a. R Squared = .46 (Adjusted R Squared = .45)
* denotes F is significant at 0.05 alpha level.

Table 2 showed ANCOVA test of students' retention scores in experimental and lecture methods. Posttest scores were used as covariate to control initial difference in the two groups. Results from the table 6 revealed that $F_{1,119} = 21.98$ and $p = 0.00$. Since $p < 0.05$, the observed difference in students' mean retention score in experimental and lecture methods was judged to be significant. Thus, the null hypothesis that there is no significant difference in the mean retention scores of students taught using computer-aided instruction and those taught by Lecture Method was rejected. Students in the experimental method retained better than their control. method counterparts because the use of computer motivated them to assimilate and recall thelearnt concepts of work, energy, power and kinetic energy.

Discussion of Findings

The finding from table 1 which indicates that the treatment is a significant factor in the achievement of basic science students. This indicates that students taught using computer-aided instruction achieved better than those taught by lecture method. The result of this study is in agreement with the findings of Yusuf (2010) who found and reported that there was significant difference in the performance of students taught by CAI and LM. Contrary to the above finding, the result is in contrast to the previous finding of Bayraktar (2008) who could not found any significant difference between the students exposed to CAI and those exposed to lecture method. The reason for the enhanced achievement of the experimental method could be that the students were stimulated to learn by the use of computer-aided instruction which spawnsinterest, excitement, total involvement in teaching and learning process, and encourage students to work at their own pace.

The result of this study supported the earlier finding of Mudasiru and Adedeji (2010)who found that the performance of students exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction. Result from table 2 revealed that the students exposed to computer-aided instruction, retained and retrieved basic science concepts learnt better than those in control group. This was shown by mean retention score of 25.12 for experimental group which was higher than that of 18.93 for control group. It thus seems that computer-aided instruction is one of the valuable strategies of impacting basic science concepts to the students in Nigerian secondary schools. This showedby the comparison of mean retention score of the experimental group with control group. There was significant difference between the retention scores of student taught basic scienceby CAI and those taught by convention method. The results are in compliance with that of Nnaobi (2013) which earlier showed that computer-aided instruction can sustain students' interest, encourage them to participate actively in the lesson and help them to retain the learnt concepts for a long time. Computer-aided instruction that utilizes the principles of explanation and seeing on the screen to encourage and elicit good responses from the students may promote meaningful learning, achievement and retention in science education.

Conclusion

Based on the findings of this research, it was concluded that computer-aided instruction in basic science enhances achievement and retention of the junior secondary students. From the foregoing, CAI may be a valuable tool for enhancing individualized instruction, achievement, retention and learning motivation.

Recommendations

On the basis of findings from this study, it is recommended that:

1. Schools should train science teachers on the use of ICT resources for science teaching and learning particularly, the use of different software packages, DVDs, CDROMs, videotapes, overhead projectors on science concepts and processes to encourage the potentials of ICT in Nigerian schools.
2. Computer literacy programme should be provided for both students and teachers for full integration of ICT resources in Science Education Programme.
3. Government, Non-Governmental Organization and Parents Teacher Associations should fund development of CAI packages in the schools, equip the schools with necessary ICT facilities and train manpower to produce software for science education in Nigerian

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