

Effect of Computer Aided Instruction on Students' Academic Achievement in Physics in Senior Secondary School in Nkanu West Local Government Area, Enugu State, Nigeria

Oguama, Bethrand Ekwundu; Ugwoke, Dennis Uchenna & Ogbodo, Joy Njiko

Department of Science Education, Degree Programme Unit, Enugu State College of Education (Technical), Enugu, *In Affiliation with Nnamdi Azikiwe University, Awka.*

Corresponding Author's Email Address: betson57@yahoo.com

Abstract

Learning is a process that needs hard work and sometimes makes students frustrated and bored. In this context, the use of computers as media in teaching-learning process is of important to attract students' attention and to make teaching-learning activities more effective and enjoyable. This study investigated the effect of computer aided instruction (CAI) on the students' achievement in Physics in Nkanu West Local Government Area of Enugu State with emphasis on gender. Quasi experimental research design was adopted. Four senior secondary school one students (SSS 1) were purposively sampled from a total of eleven senior secondary schools in the area. The sample comprised 136 SSS1 students from intact classes of co-educational schools selected randomly from Nkanu West Local Government Area in Enugu State. Data were collected using Physics Achievement Test (PAT), which was validated by two trained physics teachers. Analysis of Covariance (ANCOVA) was used to test the two null hypotheses formulated to guide the study. The finding revealed a significant difference between the mean achievement scores of students exposed to CAI and the mean achievement scores of students exposed to conventional teaching method. However, the finding revealed no significant difference in the mean achievement scores of male and female students exposed to CAI. Based on these findings, the researcher recommended that the government should often sponsor students and teachers to attend annual short-time trainings and seminars on computer literacy, information, communication and technology (ICT). Government should ensure the provision of well equipped ICT centers in every secondary school, so that the use of computer-aided instruction in the teaching and learning of Physics will be facilitated.

Keywords: Computer aided instruction, academic achievement, Physics, gender, ANCOVA

Introduction

Advancement in science and technology is an indicator of the level of national development. Science and technology improve scientific and technological literacy of the people and prepare the people for active contribution towards attaining the societal values for the overall interest of national development. They are universal links of all nations of the world into one global village. Hence, a nation that is not driven by the current trends in science and technology is disconnected from the rest of the other nations of the world. In this regard, the Federal Government of Nigeria underscores the importance of teaching and learning science -Physics inclusive (FRN, 2004).

In spite of these, studies have shown that science in Nigeria is challenged by low enrolment, negative attitude and poor achievement (Ogunleye, 1999; Oguama & Edeh, 2014). This ugly situation may not be unconnected with factors such as poor quality of teachers, poor perception and interest of students, unavailability and the use of effective teaching materials. Now, the issue is what to be done to forestall those ugly trends that punctuate the effective impartation of scientific skills and knowledge. Okoronka (2009) stated that any instructional intervention or strategy to redress poor achievement trend, low enrolment and apathy in science must essentially consider the fact that Physics is perceived to be difficult and abstract in nature, and should be able to aid learners to extract meaning and

understanding for themselves. Perhaps, the application of computer aided instruction (CAI) in the teaching and learning of Physics may attract and retain the learners' interest in Physics for deeper understanding of Physics concepts. Therefore, the integration of computer into education especially in the Physics classroom could be beneficial in building students' capacity in science and technology.

Computer aided instruction (CAI) is an instructional technique based on the principle of programmed instruction (Stennet cited in Julius, Twoli & Maundu, 2018). It makes use of a combination of tutorial, computer simulation activities and practice programs. Cotton cited in Adigun and Zosu (2012) stated that CAI supplemented conventional teaching method and produced higher achievement than the use of only conventional or traditional teaching method. Cotton added that students learnt instructional contents faster with CAI than with conventional instruction alone. CAI stimulates participation which brings out desirable behavior, knowledge and satisfaction on the part of both the learner and the teacher. It is powerful in enhancing classroom instruction as it provides an interaction between an individual learner and the computer. According to Olagunju (2013), CAI presents the instructional material just in the same way it can happen in the tutorial system between the teacher and the individual learner. It provides direct life experience in and outside the classroom so that learners can have access to education at any time and location.

Thomas and Emereole (2002) investigated the effects of a computer-based instruction (CBI) in teaching Physics at senior secondary level (form 5) in a Botswana context. Thomas and Emereole (2002) revealed significantly higher performance for the students taught using computer based instruction than the students taught using conventional method. Thomas and Emereole (2002) reported no significant difference in performance of male students and female students. Yusuf and Afolabi (2010) observed that the performance of students exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction. However, Yusuf and Afolabi (2010) stated that no significant difference existed in the performance of male and female students exposed to CAI. Adigun and Zosu (2012) revealed that junior secondary male students exposed to computer aided instruction in teaching basic technology performed better than their female counterparts that were taught using traditional teaching method.

Further study by Kareem (2015) revealed that the introduction of computer-assisted instruction into SS II Biology was statistically significant on the students' achievement. This means that the use of CAI improved students' academic achievement in Biology. Kareem (2015) added that the computer assisted instruction produced the same learning effect, and therefore showed no significant effect of gender on students' academic achievement. Olarewaju, Better and Ugwuanyi (2016) carried out a study on the effect of computer assisted instruction (CAI) on senior secondary students' achievement in chemical reaction and equilibrium in Egbeda Local Government Area of Oyo State, Nigeria. Olarewaju, Better and Ugwuanyi (2016) revealed a significant difference between the mean achievement of students taught chemical reaction and equilibrium using CAI and those taught same using conventional teaching strategy. Conversely, Olarewaju, Better and Ugwuanyi (2016) reported no significant difference in mean achievement between male and female students taught chemical reaction and equilibrium using CAI strategy. Julius, Twoli and Maundu (2018) reported that students who were taught chemistry in some selected school in Kenya using computer aided instruction performed better than the students who were taught using conventional instructional methods. reported significant mean difference in their achievement. On whether gender influences the performance of the Chemistry students Julius, Twoli and Maundu (2018) reported that boys performed better than the girls when exposed to CAI. But Julius, Twoli and Maundu (2018) noted that there was no significant gender difference in Chemistry achievement scores.

Statement of problem

In consideration of the pivotal role of Physics in scientific and technological development, every opening for poor performance and failure should not be allowed to persist. Steady poor achievement in Physics in School Certificate Examinations in Nigeria threatens the future of development of science

and technology and deserves urgent attention. The instructional problem and its consequent cause of failure in Physics may be blamed on the regular use of conventional teaching method of instruction. Introduction of computer into the secondary school science classroom in the subjects such as Biology, Chemistry, Mathematics and Physics in other countries has proved to be effective in improving teaching and learning process. Perhaps, emphasis on the use of computer aided instruction in science classroom (particularly, Physics classroom) in Nigeria may improve students' achievement in Physics and other sciences.

Purpose of study

The general purpose of the study was to investigate the effect of CAI in Physics in senior secondary school in Nkanu West Local Government Area. Specifically, the study examined the:

- i) the effect of CAI on the students' performance in Physics
- ii) the influence of gender on the academic performance of students exposed to CAI

Hypotheses

The following two null hypotheses were formulated and tested at 0.05 level of significance:

H₀₁: There is no significant difference in the mean achievement scores of students taught Physics concepts by the use CAI and those taught without CAI.

H₀₂: There is no significant difference in the mean achievement scores of male students and female students taught by the use of CAI.

Methodology

The study adopted a pre-test, post-test non equivalent control group quasi-experimental research design. Nkanu West was randomly sampled out of the 17 Local Government Areas in Enugu State as the study area. One hundred and thirty-six (136) senior secondary school one (SSS 1) Physics students constituted the sample size for the study. The sampled students were members of four intact classes, each selected from four purposively sampled co-education secondary schools. The area had a population of eleven (11) secondary schools with 2,562 SSS1 students.

The sampled students were randomly assigned equally to experimental and control groups. The treatment given to the experimental group was a computer aided instruction- a systematical designed instrument involving the use of computer, projector, screen and compact disc that was programmed with sufficient physics materials consistent with Physics scheme for the term. The control group has the conventional method of talk, chalkboard and charts.

The instrument used was Physics achievement test (PAT) that contains 20 multiple choice objective questions, aimed at measuring cognitive achievement of the students. The content value and the clarity of the instruction were validated by two trained Physics teachers. And the internal consistency reliability coefficient r was calculated using Spearman-Brown formula. The reliability coefficient r value of the instrument was 0.78. This value was high enough to satisfy the reliability of the instrument.

The topics taught were electric charged bodies, field lines, electric current, insulation and conductors. With the exception of the instructional resources, every other teaching procedure remained constant as both the experimental and control groups were taught by their teachers, under the strict supervision of the researcher. The researcher had earlier assessed the computer proficiency of the teachers and found out that they had sufficient computer knowledge to use CAI. The experimental group was taught using computer aided instruction while the control group was taught using the conventional method.

Prior to the treatment, a pre-test was administered to both groups and the result of each student recorded. At the end of the treatment that lasted for a period of 3 weeks, a post test was conducted for

the experimental and control group. Both the pre-test and the post-test scores were collated and analyzed using descriptive statistics and analysis of Covariance (ANCOVA) test the hypotheses.

Results

The Physics Achievement Test scores (PAT) were subjected to analysis of covariance (ANCOVA) and the results are presented according to the formulated hypotheses.

Hypotheses 1

H_{01} : There is no significant difference in the mean achievement scores of students taught Physics concepts by the use CAI and those taught without CAI.

The data for testing the hypothesis are shown in Table 1.

Table 1: Analysis of Covariance (ANCOVA) in the Achievement Mean Score between the Experimental and Control Groups in the PAT.

Source	Type III Sum of Squares	df	Mean Square	F-ratio	Sig. of F-ratio	Partial Eta Squared
Corrected Model	1185.830 ^a	2	592.915	3.745	.026	.053
Intercept	23628.593	1	23628.593	149.240	.000	.529
PRETEST	44.389	1	44.389	.280	.597	.002
GROUP	1097.884	1	1097.884	6.934	.009	.050
Error	21057.435	133	158.327			
Total	494480.000	136				
Corrected Total	22243.265	135				

The F-ratio value was 6.934 with level of significance 0.009 for groups. Since 0.009 is less than acceptable error of 0.05, the null hypothesis H_{01} which states that here is no significant difference in the mean achievement scores of students taught Physics concepts by the use CAI and those taught without CAI is rejected. In other words, there is a significant difference in the mean achievement scores of students taught Physics concepts by the use CAI and those taught without CAI.

Hypotheses 2

H_{02} : There is no significant difference in the mean achievement scores of male students and female students taught by the use of CAI.

The data for testing the hypothesis are shown in Table 2.

Table 2: Analysis of Covariance (ANCOVA) in the Achievement Mean Score between the Male and Female in the PAT

Source	Type III Sum of Squares	df	Mean Square	F-ratio	Sig. of F-ratio	Partial Eta Squared
Corrected Model	456.144 ^a	2	228.072	1.396	.255	.041
Intercept	12823.800	1	12823.800	78.476	.000	.547
PRETEST	.614	1	.614	.004	.951	.000
Gender	454.928	1	454.928	2.784	.100	.041
Error	10621.739	65	163.411			
Total	270984.000	68				
Corrected Total	11077.882	67				

As shown on Table 2, the F-ratio value for gender was 2.784 with a significant value of 0.100. The F significant value (0.100) is greater than 0.05 significant or the acceptable error. Hence, the null hypothesis H_{02} which states that there is no significant difference in the mean achievement scores of male students and female students taught by the use of CAI is not rejected.

Discussion of the Findings

The finding of this study revealed that the achievement of students taught using computer-aided instruction (CAI) is significantly better than the students taught without CAI. Again on gender issue, the finding revealed that there was no significant difference in the mean achievement scores of male and female students taught with computer-aided instruction.

Both findings agree with the past and present studies by Thomas and Emereole (2002), Yusuf and Afolabi (2010), Adigun and Zosu (2012). Others include Kareem (2015), Olarewaju, Better and Ugwuanyi (2016) and Julius, Twoli, and Maundu (2018). The authors reported that there was significant difference between the mean achievement scores of students taught using CAI and students taught without CAI (or using conventional method). The difference was in favour of students taught with CAI. In addition, they revealed that there was no significant difference between the mean achievement scores of male and female students taught using CAI.

It is clear that the findings of this study suggest that the use of computer aided instruction must have facilitated and improved instruction; therefore demonstrated more superiority over conventional method in retaining students' interest and enhancing students' achievement in Physics. These imply that instructional strategy matters in teaching of sciences especially in Physics. Once the instructional strategy is functional, it motivates and retains students' interest and makes learning quite effective. Also, a functional instructional strategy such as CAI accommodates the learning disabilities that may be engendered by gender factor; therefore accounts for comparable performance between the male and female students.

Conclusion and recommendation

The use of computer aided instruction significantly improved students' achievement in Physics more than the conventional method of teaching. It is capable of managing gender learning disabilities and hence, produces no significant effect in the Physics achievement of male and female students in senior secondary school.

Based on these findings, the researcher recommended that the government should often sponsor students and teachers to attend annual short-time trainings and seminars on computer literacy, information, communication and technology (ICT).

Government should ensure the provision of well equipped ICT centers in every secondary school, so that the use of computer-aided instruction in the teaching and learning of Physics will be facilitated.

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