

## Effects Of Computer - Assisted Instruction On Academic Achievement Of Nigeria Certificate In Education Physics Students, In Niger State, Nigeria

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**Abstract:** The study investigated the effect of computer- assisted instruction on academic achievement of Nigeria Certificate in Education Physics students, in Niger State, Nigeria. Two research questions were raised and two null hypotheses were formulated to guide the study. The study adopted pre-test and post-test quasi experimental control group design. Two hundred and eleven (211) NCE II students from the two colleges of education in Niger State were used as research sample. The purposive sampling techniques using balloting method was employed to assign the colleges into experimental and control groups. The researcher developed computer- assisted instructional package on Mechanics and Properties of Matter which was used as treatment instrument for experimental group, while control group were exposed to traditional lecture teaching method. The instrument for data collection was Mechanics and Properties of Matter Achievement Test (MPMAT) which was validated by two experts in science education. A 40- items multiple choice objective type achievement test covering six topics in Mechanics and Properties of Matter was used to collect data for both pre and post test. A reliability coefficient of 0.78 was obtained using the Pearson's Product Moment Correlation Coefficient formula ( $r$ ). The data collected from the study were analyzed using t- test. The findings of this study revealed that experimental group performed better than the control group, no statistically significant difference in the performances of both male and female students taught with CAI which implies that CAI is gender friendly. It was recommended among others, that Physics Lecturers should continuously use computer software in teaching physics as it guarantees improvement in student's achievement in physics.

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**Key words:** Computer- Assisted Instruction; Academic Achievement; Mechanics and Properties of Matter.

### 1. Introduction

Building of a better nation is the concern of every good citizen, as science educators are not left-out of this trend, and there concern always is to see that young scientists are given the best basic scientific knowledge, therefore they provide more pedagogies for impacting the knowledge. The world has shifted to computer era, for that the teaching and learning as to move with the current trend. The teaching and learning with the aid of computer is the weather of the day. Computers offer exciting approaches to teaching that were not even dreamt of many years ago, but the extent to which the educational potential of computer technology will be realized remains to be seen (Amara, 2006). Computer technology has caught the attention of many researchers and educators and computer-based instructional applications are considered effective alternative to traditional teaching method (Yushau, 2006). Research findings explicitly reported that science education and computer technology had created a meaningful partnership over the century (Flick & Bell, 2000). The researcher found

that, computer assisted instruction is one of the pedagogy that facilitate the impact of scientific knowledge to the learners easily.

Physics as one of the science subject is not exempted from this gain. Ogunneye (2003) noted that the study of Physics has been and will continue to be of tremendous importance to humanity for its ability to explain natural phenomena and everyday occurrences as well as its central role in the world's current technological development. Atadoga (2001) observed that Physics is an aspect of science that helps to explain the cause-effect relationships of matter and energy, and their application to natural phenomena. Physics helps to transform the world. In addition, Danjuma (2008) stated that Physics as the soul of science plays a vital role in all human endeavours and serves as a pre-requisite subject for courses such as medicine, geology, computer engineering, forestry, space navigation, agricultural science, pharmacy, among others. Researchers viewed that Physics accord its respect from people for the fact that it contributes

to the knowledge, growth and development of individuals in particular and the society in general.

Gender roles can be referred to as the roles and relationships between men and women in a given situation. On the issue of gender on students' achievement in science subjects, Shaibu and Mari (1994) found that there was no statistically significant difference between boys' and girls' ability to solve problems requiring their understanding of process skills. Also James (2000), Olorukooba (2001) and Bichi (2002) in their various studies found that there was no statistically significant difference between boys' and girls' achievement in science with reference to their exposure to activity-based method of instruction in science. Therefore, this study investigated the effect of CAI on gender of NCE Physics students in Niger State.

Lecture method is the teacher-centered method, which is seen as the traditional talk-chalk method of teaching. The teacher does the talking while students serve as passive receiver only by listening and taking down notes. Obeka (2009) described lecture method as a teacher-centered method. He further stressed that the method enhances acquisition of subject matter predominantly under the memorization and close supervision of the students by the teacher. Lecture method is one of science teaching instructions that encourage rote learning and regurgitation of information without necessarily facilitating understanding, and this does not enhance academic achievement in science (James, 2000, Bichi, 2002 & Usman, 2008). Though this method has some disadvantages, teachers often use it. Therefore, there is need to try an alternative teaching strategy such as CAI in line with global trends.

Research finding of Bunkure (2007) indicated that CAI enhanced students' achievement in physics but teachers did not often use it. Rather they used lecture methods and thus, there is the need to try a new teaching strategy in line with global trends of using CAI, especially for science teaching. Danjuma (2015) observed that the use of CAI instruction creates and sustains students' attention and curiosity in the learning process, the use of CAI is also likely to enhance the learning of Physics concepts. Computer-based learning has the potential to facilitate development of students' decision-making and problem-solving skills, data-processing skills, and communication capabilities. By using computer, students can gain access to expansive knowledge links and broaden their exposure to diverse people and perspectives (Bakac, Kartal & Akbay, 2011). Many studies in the published literature indicate that there is a strong relationship between the use of computers and students' academic achievements in teaching and learning processes (Altun, Yigit & Alev, 2007). For

instance, Yigit (2005) found in his study that computer-assisted instruction has had a positive impact on students' perception about computer supported instruction as well as on their academic achievement.

Owolabi (2007) worked on the use of analogy as a vehicle for achieving effective Physics delivery in some selected senior secondary schools in Lagos. The study sample consisted of 112 senior secondary school (two) Physics students drawn from two randomly selected secondary schools in Lagos, Nigeria, he used questions adopted from Owaseye (2000). The test was to find out specific information regarding the concepts of mirror and lenses which many students often confuse or use interchangeably. The result showed that the experimental group performed significantly better than the control group after a posttest. It showed that there was statistically significant difference between the mean scores of experimental and control groups. This is an indication that there was a significant influence of analogy on students' achievement in Physics. The findings of this study are relevant and a useful guide to the present study.

Salahudeen (2012) investigated the effects of Computer-Assisted Instructional package on Learning of Longitude and Latitude among Secondary School Students in Minna Metropolis. The study used 120 Senior Secondary School (SSS) Students and adopted the pretest and posttest quasi experimental control group design. The result revealed that the experimental group performed better than the control group. Gender and age differences were found to have no significant effect on the mean achievement of the experimental group. This study is relevant to the present study in terms of instrument (CAI), gender and location and would serve as guide to the present work.

In the recent study of Alhassan (2012) on effects of computer assisted instructional package on achievement and retention in geometry among Junior Secondary School Students in Minna Metropolis, the study used 80 Junior Secondary School (JSS) Students and adopted the pretest, posttest quasi experimental-control group design. The finding revealed that the experimental group performed better than the control group and male students performed better than female students when taught geometry using computer. This study is relevant to the present study that is the subjects are Nigerlites and CAI is used. The study also tried to see the effect of computer assisted instruction on academic achievement of students similar to the present study.

## 1.2 Statement of the Problem

Many studies in published literature indicated that there was a strong relationship between the use of computers and students' academic achievements in

teaching and learning processes (Altun, Yigit & Alev, 2007). For instance, Yigit (2005) found in his study that computer-assisted instruction had positive impact on students' perception about computer-supported instruction as well as on to their academic achievement. Therefore, the problem of this study is to look at the effect of Computer-Assisted Instruction (CAI) on the academic achievement of NCE Physics students in relation to their ability levels in Niger State, Nigeria.

### 1.3 Purpose of the Study

The purpose of this study is to determine the effect of Computer-Assisted Instruction on academic achievement of Nigeria Certificate in Education Physics Student, especially in the learning of Mechanics and Properties of Matter II concept at NCE level and also to assess the students' performances according to gender.

### 1.4 Research Questions

This study was aimed at finding answers to the following questions

1) What is the difference between academic achievement of Physics students taught using CAI and those taught using lecture method at NCE level?

2) Is there any significant difference in the academic achievement between male and female Physics students taught with CAI at NCE level?

### 1.5 Research Hypotheses

Based on the above research questions, the following null hypotheses were formulated and tested at 0.05 level of significance.

$H_{01}$ : There is no significant difference in the academic achievement between Physics students taught using CAI and those taught using Lecture method in Physics at NCE level.

$H_{02}$ : There is no significant difference in the academic achievement between male and female students taught using CAI in Physics at NCE level.

### 1.6 Scope of the Study

The study investigated the effect of Computer – Assisted Instruction on academic achievement of NCE Physics Students in Niger State. The study was restricted to the only two colleges of education in Niger State i.e. Federal College of Education, Kontagora and Niger State College of Education, Minna. The Colleges of Education were accredited by National Commission for Colleges of Education (NCCE) and were similar in terms of academic activities, quality of staff and infrastructure. The study was limited to Physics students in NCE II (200 Level) of the two Colleges of Education under study. The study was also limited to Mechanics and Properties of Matter with the following concepts: Inertial of Rigid body, Energy and Gyration of Rigid body, Angular

Momentum, Gravitation, Surface Tension and Oscillatory and Circular Motion.

### 1.7 Significance of the Study

The findings of the study would hopefully uplift the standard of Physics education in the following ways:

The study would contribute to the improvement of teaching and learning of Physics in Nigeria's institutions of learning. That is to say it would help to improve teachers' effectiveness and confidence in the classroom during instruction and hence improve students' achievement on selected Physics concepts. The students learning rates and retention would also be enhanced.

It would encourage active participation of the students in teaching and learning of Physics which would lead to meaningful learning outcomes, it would stimulate the curriculum developers and administrators to encourage lecturers in all subject areas to acquire skills and attitude for developing CAI instructional materials for teaching, it will enable administrators of higher institutions to organize and sponsor workshops, seminars and in-service trainings for their lecturers with a view to making use of CAI as one of the methods of teaching at NCE level.

Learning difficulties may be reduced using CAI and this will help to remove the abstractness of some concepts. Fellow researchers will benefit from the findings of this study by gaining access to recent literature and it will make them be acquainted with present solutions of using CAI in teaching Physics at NCE level. This study would also serve as a foundation for further studies in the teaching of Physics.

### 2. Research Design

The study adopted pre-test, post-test quasi-experimental control group design as recommended by Kerlinger (1973). Two groups, experimental and control groups were used in the study. The two groups were pretested using Mechanics and Properties of Matter Achievement Test (MPMAT) before treatment in order to determine the entry level equivalence in ability of the two groups. The experimental group was taught using Computer-Assisted Instruction (CAI) while the control group was taught using lecture method. After the treatment, Posttest was administered to the subjects of the two groups to determine the efficacy on the use of Computer-Assisted Instruction compared to Lecture Method employed in the teaching of the concepts. The same test was administered as pre-test, and as post-test.

### 2.1 Population

The target population for this study consisted of all N.C.E 200 level Physics students of the two Colleges of Education in Niger state.

The total Physics students' population in the two colleges at the time of the study is 211 students, consisting of 129 male and 82 female students. The colleges are co-educational and offer Mechanics and Properties of Matter as courses in Physics (PHY 213).

### 2.2 Sample and Sampling Procedure

The entire population was also used as the sample for the study, because of the limited number of students that offer physics at NCE level. The sampling technique used was the balloting method (the first school picked was the control group and the second school picked served as the experimental group). The technique was used to assign the colleges into experimental and control groups, which were used for the study.

### 2.3 Research Instrument

The instrument used for data collection on this study was the Mechanics and Properties of Matter Achievement Test (MPMAT). Mechanics and Properties of Matter Achievement Test (MPMAT) was developed by the researcher. Mechanics and Properties of Matter Achievement Test was used for the pretest and posttest. The MPMAT test items were made up of 40 multiple choice questions with four options, to choose the correct option. Only one option was correct the remaining three options served as destructors. The items covered the units taught.

### 2.4 Validation of the Instrument (MPMAT)

The MPMAT instrument with the marking scheme was validated by two senior lecturers with qualification of PhD from Department of Science and Science Education of Federal University of Technology (FUT) Minna and two senior lecturers with qualification of PhD from Department of Science Education, Ahmadu Bello University Zaria respectively. They evaluated the instrument for its face and content validity for accuracy, clarity and level of phrasing of the test items.

The experts validated the MPMAT instrument to ensure it was in consonance with the NCE Physics syllabus. The instrument was also validated to ensure that it was appropriate and served the purpose for which it was designed. Face validation was undertaken to determine whether the MPMAT was appropriate or not. Face validity pertained to whether the test was valid to the examinee who would take it. Content validation was similarly undertaken to see whether the MPMAT instrument was in consonance with the syllabus.

### 2.5 Data Collection Procedure.

The response of the subjects to Mechanics and Properties of Matter Achievement Test was scored using the marking scheme. Each correct response was scored one point with a maximum score of 40 marks.

The scores were collected and recorded based on each research question, hypotheses and ability levels.

### 3. Data Analysis

The scores that were obtained from MPMAT were used for testing two null hypotheses.

$H_{01}$ : There is no significant difference in the academic achievement between Physics students taught using CAI and those taught using Lecture Method in Physics at NCE level.

$H_{02}$ : There is no significant difference in the academic achievement between male and female students taught using CAI in Physics at NCE level.

The two null hypotheses stated were analyzed using t-test statistic to determine the effect (if any) between the experimental and control groups. Significant level at  $P \leq 0.05$  was used to reject or retain the stated hypotheses.

#### 3.1 Answers to Research Questions

The result is presented as follows:

**Research Question 1:** What is the difference between academic achievement of Physics students taught using CAI and those taught using Lecture Method at NCE?

The descriptive statistics such as mean and standard deviation was used to test this research question and the summary of the results is presented in Table 1.

**Table 1 Means and Standard Deviation of Post-test of the Experimental (CAI) and Control (Lecture) Groups in Mechanics and Properties of Matters Achievement Test (MPMAT).**

Variable	N	Mean	SD	Mean Difference
Experimental group	113	66.22	14.26	30.04
Control group	98	36.18	8.17	

Based on Table 1, the answer to question one which states: "What is the difference between academic achievement of Physics students taught using CAI and those taught using lecture method?" is that the mean score for the experimental group was 66.22 and that of the control group was 36.18. This indicates that there is significant difference between the mean scores of the experimental group (66.22) and the control group (36.18). The mean difference is 30.04 in favour of experimental group. Therefore, the answer to the research question one is that there exist significant differences in favour of experimental group. To test whether there was a significant difference or not in the mean score of the experimental and control groups,  $H_{01}$  was used.

**Research Questions 2:** Is there any significant difference in the academic achievement between male and female Physics students taught with CAI at NCE?

The descriptive statistics such as mean and standard deviation was used to test this research question and the summary of the results is presented in Table 2.

**Table 2. Means and Standard Deviation of Post-test of Male and Female Physics Students taught using CAI.**

Gender	N	Mean	SD	MD
Male	68	67.29	14.53	2.69
Female	45	64.60	13.85	

Based on Table 2, the answer to question five which states: "What is the difference in academic achievement of male and female physics students taught using CAI?" is that the mean score for the male was 67.29 and that of the female was 64.60. This

**Table 3: Two Sample t-test on Achievement Score in Physics by Experimental and Control Groups.**

Type	N	Mean	S D	S E	t-value	DF	MD	P	Remark
Experimental	113	66.22	14.26	1.34	18.40	209	30.04	.0001	Sig.
Control	98	36.18	8.17	0.83					

\*Significant at  $p \leq 0.05$

The result in Table 3 revealed that students who were exposed to the CAI significantly performed better in their achievement when compared to students in the control group who were not exposed to the treatment. Moreover, the level of significance obtained for the test is 0.0001 ( $p \leq 0.05$ ). Therefore, the null hypothesis that there is no significant difference in the academic achievement between Physics students taught using CAI and those taught using Lecture method in Physics at NCE level is rejected. The result is a clear indication that students exposed to the Computer-Assisted Instruction (CAI)

**Table 4: Two Sample t-test on Scores of Male and Female Students in Experimental Group.**

Gender	N	Mean	S D	Std. Error	t-value	DF	MD	P	Remark
Male	68	67.29	14.53	1.76	0.98	111	2.69	0.328	NS
Female	45	64.60	13.85	2.06					

\*Significant at  $p \leq 0.05$

The result in the Table 4, did not reveal significant difference between the male and female students who were exposed to the computer-assisted instruction method in their academic achievement. The p-value obtained from the test as indicated in the table is 0.328 which is greater than p-value of  $p \leq 0.05$ . Therefore, the null hypothesis that there is no

indicates that there is no significant difference between the mean score of the male (67.29) and the female (64.60). The mean difference is 2.69 in favour of the male. Therefore, the answer to research question two is that there exists significant difference in favour of the male. To test whether there was a significant difference or not in the mean score of the male and female,  $H_0$  was used.

#### Hypotheses Testing

The results are presented in Tables 3 and 4

#### Null Hypothesis I

**H<sub>01</sub>:** There is no significant difference in the academic achievement between Physics students taught using CAI and those taught using Lecture method in physics at NCE level.

This hypothesis was tested by selecting the scores of the experimental group who were subjected to the treatment and the score of the control group to a two sample t-test after the experiment. The result of the test is summarized in Table 3.

method were better in their performance than those exposed to Lecture Method.

**H<sub>02</sub>:** There is no significant difference in the academic achievement between male and female students taught using CAI in Physics at NCE level.

To test this hypothesis, the posttest mean scores of the male and female students who were exposed to the computer-assisted instruction method after the treatment were used as the dependent variable. The result of the two sample t-test used to compare their differences in the performance is summarized in Table 4.

significant difference in the academic achievement between the male and female students taught using CAI in Physics at NCE level is not rejected. The result showed that the treatment had equal enhancement on the performances of the male and female students who were exposed to it. Therefore, the CAI is gender friendly.

### Discussion of the Results

The test for Hypothesis I reveals that students exposed to the use of the CAI were found to be significantly better in their performance than those who were taught with the conventional lecture method. The implication of this finding is that the use of the CAI enhances students' performance in Physics than the use of the lecture method. The result supports the findings of Akour (2006); Orisebiyi (2007), Yusuf and Afolabi (2010) and Danjuma (2015) who reported a significant difference in the performance of students taught using CAI. The result is however, not in agreement with the previous findings of Huxford (as cited by Jenks and Springer, 2002), Imhanlahimi and Imhanlahimi (2008) and Owusu (2009) who discovered that those taught using conventional method performed better than those exposed to CAI. The result shows that the treatment given to the experimental group had a positive effect on them as it shown by the higher mean score. This might be due to change in mode of instruction that is from teacher-centred (i.e. lecture method) to student-centred (i.e. computer-assisted instruction).

Hypothesis II which states that "There is no significant difference in the academic achievement between male and female students taught using CAI in physics at NCE level" was tested using t-test statistics. The result reveals that there is no significant difference in the academic achievement of male and female students. This implies that Null Hypothesis II is accepted. The result is not in agreement with the findings of Hassan (2012) and Salahudeen (2012). They reported significant difference between the performances of male and female students in favour of females. But the finding is in agreement with the findings of Yusuf and Afolabi (2010), Bello (1996) in Achuonye (2011) and Danjuma (2015), who stated that gender has no influence on performance of male and female pupils exposed to CAI.

### Conclusion

The findings of this study have shown that academic achievement on mechanics and properties of matters among physics students of different abilities at NCE level enhanced by usage of Computer-Assisted Instructional package. The used of CAI package does not discriminate between genders in academic achievement thus, CAI is gender friendly at NCE level. It was generally observed that Computer-Assisted Instruction (CAI) has the potential of enhancing NCE students' academic achievement in Mechanics and Properties of Matters concepts, and this may be because it is based on both hands-on and minds-on strategies.

### Recommendations

From the findings of this study, the following recommendations are made:

- a. The use of Computer-Assisted Instruction (CAI) should be encouraged by NCE Physics teachers in teaching Mechanics and Properties of Matters concepts because it enhance the performances of the students.
- b. Teaching and learning materials such as computers should be provided by government agencies such as State Governments, Federal Ministry of Education, and National Commission for Colleges of Education (NCCE) for effective utilization of Computer-Assisted Instruction (CAI) in teaching/learning Mechanics and Properties of Matters concept at NCE level.
- c. Individual Physics lecturers should be computer literate so that they can develop appropriate computer-assisted instruction software.
- d. The Computer-Assisted Instruction (CAI) should be incorporated into teacher education curriculum and be taught as other teaching methods since it is a relatively new technique with many stages for its successful implementation.

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