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EFFECT OF COMPUTER ASSISTED INSTRUCTION ON ATTITUDE AND PERFORMANCE IN DIFFICULT CONCEPTS IN PHYSICS AMONG SECONDARY SCHOOL STUDENTS IN ZARIA, NIGERIA

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Abstract
This research work was undertaken to ascertain the effect of Computer-Assisted Instruction (CAI) on Attitude and Performance in Difficult Concepts in Physics among Secondary School Students in Zaria, Nigeria. The population for this research consists of all the physics Students from twenty-five public secondary schools (11,499). The sample of the study was taken from two schools with availabilities of equivalent Computer facilities and manpower. The research design for this work was quasi-experimental pre-test/post-test control group design. The students were grouped into control and experimental groups. Two methods were used in this study: the CAI method and the Lecture method. The experimental group was taught with CAI while the control group was taught with the lecture method only. Three difficult concepts (concept electricity, projectile motion and equilibrium of force) in physics were taught. The experiment was conducted for 6 weeks. A validated Physics Achievement Test (PAT) was used for data collection in this the study. SPSS package was used to determine mean, standard deviation and t-test analysis. Results showed that there was a significant difference in the mean scores of the two groups ($P= 0.00 < 0.05$). Findings also revealed that the there is no significant difference in the attitude of both groups. It was recommended that the CAI approach should be used to teach difficult concepts in physics subject.

Keywords: Computer Assisted Instruction, Physics, Performance, Difficult Concepts, Student

Introduction

Physical science subjects such as Physics have concepts that are practical oriented and involves activities in our daily life. Physics as a subject is significantly placed in the Nigeria Senior Secondary School Science Curriculum. In order to get placement for admission to read any science-based course in Nigerian tertiary institutions, physics must be passed at the credit level. This is contained in the National Policy in Education (FRN, 2020). Also, in the secondary school-specific National Education Scheme, the goals of studying physics includes among others: providing fundamental knowledge in the field for everyday life in society and developing fundamental scientific knowledge and attitudes in order to be ready for the technical applications of physics. This emphasizes that fundamental ideas and physics principles are essential for the advancement of technology at the national level. The goal of teaching physics in secondary schools is to produce young scientists who can create technical innovations that make daily life easier

and more comfortable (Josiah *et al.,* 2019). Thus, it means that one of the key subjects in technology is physics. The degree of technology and the demographics of a society serve as indicators of its level of development. To improve sustainable technological development in Nigeria, substantial attention must be paid to the teaching and learning outcomes of this crucial subject. Some challenging and difficult concepts in Physics were noted in the West Africa Examination Council (WAEC) Chief Examiners' Reports from 2005 to 2013; Bello *et al.,* (2018).and Onyewuchi *et al.,* (2021) viz: rectangular and triangular prisms, Electromagnetic fields, radioactivity, concave and convex lenses, simple harmonic motion, density and relative density, energy quantization, electric current, alternating current (A.C.) circuits, fluid at rest and in motion, heat energy, waves, gas laws and projectile motion. These are among the secondary school physics contents that are expected to be taught. There is need to intergrate modern innovative method such as Computer-Assisted Instruction into learning of physics.

Computer-Assisted Instruction (CAI) is a teaching strategy that makes use of one or more computer programs to support students' education (Usman & Madudili, 2020). Its main objective is to deliver useful teaching through engaging interactive programs. The approach was originally made available in the 1960s and since then, technology has advanced to the point where computers are now an essential component of education in wealthy nations in the twenty-first century (Gunawardhana, 2020). In general, it refers to educational activities where a computer program is used to instruct a passive learner or to courses where the computer serves as a platform for the building of a personalized and interactive learning environment. The application of CAI changes because CAI programs never adhere to a single theoretical paradigm of instruction, regardless of target audience or subject. Many of them structure the learning process as a teacher and student dialogue. In an effort to promote the learning process, the programs aim to provide an engaging and inspiring setting. A special type of student engagement with the computer screen is provided by CAI applications. The CAI has a number of features that make learning easier. These include the capability of personalizing information, the presence of animated objects on the screen, the availability of practice activities that incorporate challenges and curiosity, the fact that it offers a fantasy context and gives the learner control over their own learning process (Ekundayo, 2022). Also, Ekundayo (2022) in his research titled Effects of Computer Assisted Instruction on Students Academic Achievement in Chemistry among Boys and Girls in Public Secondary Schools in Ondo State, Nigeria reported a significant difference in achievement of students taught with CAI and lecture.

Personalizing a lesson has the benefit of increasing pupils' enthusiasm in a particular task. If a person's name or other familiar settings occur in a problem, it will be simpler for them to assimilate new knowledge. This is particularly valid when discussing the education of children (Gambari *et al.,* 2012). When working with natural sciences like physics, CAI's functionality is extremely useful. It enables the learner to carry out, look for and identify processes, as well as to establish more informative relationships (Gambari, 2010). As opposed to traditional teaching approaches, CAI offers students a situation that is more interesting and difficult, which increases student’s motivation and attitude. Making decisions gives the student a sense of greater competence and self-determination, which is facilitated by the use of computers in the educational process.

Studies on attitudinal change of students taught with CAI have not been consistent. Some revealed a significant positive change while others not significant. Positive attitude among

students may impact their academic success in the context of education (Nja *et al.,* 2022). Chebotib and Kering (2021) and Ude and Onah (2022) reported in their studies that CAI improved students attitude in biology subject event though the difference in attitude change was not significant. In mathematics subject, Gambari *et al.,* (2013) and Aliasgari *et al.*, (2021) among others also reported improvement and significant difference in favour of students taught with CAI. There is little or no studies carried out to determine change in attitude among secondary school students in Physics subject. This study therefore intends to determine the Effect of Computer-Assisted Instruction on Attitude and Performance in Difficult Concepts in Physics among Secondary School Students in Zaria, Nigeria

Statement of the Problem

Using computers in education and learning is a yearning that Nigeria advocates for to pursue technological progress. Physics is a prerequisite to study all science and technology courses at tertiary institutions, nonetheless secondary school students' performance have been both unsatisfying and encouraging. Technology growth in education is sluggish, contributing significantly to Nigeria's underdevelopment. There is a need for restitution and for technology to flourish in a beneficial way. Given that physics is one of the most important courses for providing the foundational improvements required in technology, effective teaching and learning are critical considerations. As a result, the goal of this research is to design and analyse the impact of computer-assisted instruction on secondary school physics students' attitude and performance in Zaria, Nigeria.

Objectives of the Study

The Objectives of the Study are to:

1. ascertain the impact of CAI on students' physics performance
2. Determine the difference in attitude among students taught with CAI and lecture Method.

Research Questions

The following research questions will be answered:

1. What is the difference between the mean scores of students taught with CAI and those taught using lecture method?
2. Is there any difference in the attitude of students' taught with CAI and those taught using lecture method?

Research Hypotheses

The hypotheses stated for this study are:

HO_1: There is no significant difference in the mean scores of students taught with CAI and those taught using lecture method

HO_2: There is no significant changes in the attitude of students' taught with CAI and those taught using lecture method.

Methodology

The study adopted quasi experimental design. The population of this study encompassed all students from twenty-five (28) public senior secondary schools totalling 11,499 located in Zaria Educational zone of Kaduna state. The sample (144) consisted of two intact classes randomly selected from two public secondary schools based on the availabilities of equivalent ICT facilities, manpower and enrolment of students for SSCE physics examination. The groups were randomly assigned. Control group consists of 75 students while experimental group has 69. Three difficult concepts (concept electricity, projectile motion and equilibrium of force) in physics were selected. Duration for each period of lesson was 45 minutes. The experiment was conducted for 6 weeks. The senior secondary class SS III physics students were first pretested, followed by administration of treatment using validated Physics Education Technology (PhET) interactive simulation package to the experimental group. Control group were taught the same concepts using

lecture method. Immediately after the treatment, post-test was then administered to both experimental at control groups. The Physics Achievement Test (PAT) was used for data collection in this the study. The PAT comprises 25 multiple-choice physics questions adopted from past examination question of West African Examination Council (WAEC, May/June 2010-2015). Each of the items of the PAT has four options (A-D) as possible answers to the question. And students were required to indicate the correct answers by ticking one of the letters (A-D) and which lasted for the period of one hour. Analysis of data was be done using mean, standard deviation, t-test statistics and Mann-Whitney U Test with SPSS version 20.0 to test the hypotheses at 0.05 alpha levels.

Results

Table 1: Summary of t-test analysis of Mean Performance of Students taught with CAI and those taught with Lecture Method

Groups	N	Mean	SD	SE	Df	Tcal	P value
CAI	69	15.04	4.11	0.47	142	12.30	0.00
Lecture	75	8.71	1.88	0.22			
Total	150						

***Significant* @ p < 0.05**

The t test results showed that there was significant difference between the mean scores of students taught with CAI and Lecture methods. The mean academic achievements were 15.04 and 8.71 respectively with a mean difference of 6.33. The p = 0.00 < 0.05 indicate a significant difference among mean values.

Table 2: Summary of Mann-Whitney U Test Analysis of Attitude among Students in experimental (CAI method) and Control (lecture method) groups.

Groups	N	Mean	SD	SE	Df	U	P value
CAI	69	11.01	3.61	0.73	142	4.46	0.00
Lecture	75	6.81	1.02	0.12			
Total	**142**						

***Significant* @ p < 0.05**

The Mann-Whitney U Test revealed that significant differences exited in the attitude of students in physics. The mean of experimental group (those taught with CAI) is 11.01 and that of control group (those taught with lecture method) is 6.81 with a mean difference of 4.20. The p value of 0.00 is lower than the 0.05 alpha level of significance at degree of freedom of 142.

Discussion

Results in Table 1 showed that there was a significant difference in the mean scores of the two groups (P= 0.00 < 0.05). this indicate that CAI method enhanced performance of students better than lecture method. Therefore, the null hypothesis which states that there is no significant difference in the mean scores of students taught with CAI and those taught using lecture method is hereby rejected. The result has shown that students taught with CAI method performed significantly better than those taught with lecture method. Result is similar to Pol *et al.*, (2005), Onasanya (2006), Yusuf (2006), Kara (2008), Gambari (2010) and Gunawardhana (2020) who all reported significant difference in performance across all subjects. Also, Ekundayo (2022) in his research titled Effects of Computer Assisted Instruction on Students Academic Achievement in Chemistry among Boys and Girls in Public Secondary Schools in Ondo State, Nigeria reported a significant difference in achievement of students taught with CAI and lecture.

Table 2 presented Mann-Whitney U test analysis of difference in attitude among secondary school physics students taught with CAI and lecture methods. Results indicate a significant difference in attitude with P= 0.00 < 0.05. Hence, the null hypothesis which states that there is no significant difference in the attitude of students was hereby rejected. The findings are similar with studies of Soyibo and Hudson (2010), Orji and Leo (2010), Gambari *et al.*, (2013) and Aliasgari *et al*., (2022) who

all reported a significant difference in attitude in favour of those students taught with CAI. Studies by Chebotib and Kerling (2021) and Ude and Onah (2022) revealed that CAI increased learning level as well as improved students attitude in biology subject, but the difference was not significant.

Conclusion

The results of this study demonstrated the benefits of Computer-Assisted Instruction (CAI) in the training of a number of challenging and difficult physics concepts as well as its influence on the attitude of physics students. The results show that if the CAI approach is successfully applied, it improves the performance of physics students in senior science secondary schools. Although it is challenging to assess the effectiveness of any teaching strategy, numerous studies have demonstrated that CAI increases exam performance, enhances student attitudes and shortens the amount of time needed to comprehend a given subject.

Recommendations

This study recommends the following:

1. Given CAI's success in teaching difficult topics in Physics, it may be used to teach difficult concepts in other areas.
2. Teachers should adopt CAI method for teaching Physics subject.
3. Kaduna State government should create a conducive environment to facilitate teachers and students use of CAI method.

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