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Effects of Computer-Assisted Instruction on Students' Achievement in Secondary Schools' Physics in Ondo State, Nigeria

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Abstract: The study investigated the effects of Computer-Assisted Instruction on the performance of secondary school students in Physics in Ondo State, Nigeria. The study adopted quasi-experimental pre-test post-test control group design. A total of 200 senior secondary school students drawn out of eight secondary schools in Ondo State formed the sample. Physics Achievement Test (PAT) was used to collect data for the study. Two hypotheses were generated and tested using t-test analysis at 0.05 level of significance. The findings revealed there is a significant difference in the pre-test and post-test means scores of the experimental and control groups. There was also a significant difference among male and female students' performance in Physics using Computer-Assisted Instruction. Based on the findings, physics teachers should recognize the potentials of Computer Assisted Instruction and utilize them for effective teaching and learning of Physics. A conducive learning atmosphere that will accommodate the use of Computer-Assisted Instruction should be provided in secondary schools.
Keywords: Achievement, Computer-Assisted Instruction, Effective Teaching and Learning, Learning Atmosphere and Potentials.

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Introduction

Physics plays an important role in explaining the events that occur in the universe based on the physical laws and principles that can be found in all the events around us. The feasibility of the technological advancements of the world today came through the study of science of which physics plays a major role.

According to Edermir (2009), Physics as the soul of science, plays a vital role in all human endeavour and serves as a pre-requisite for courses such as medicine, geology, computer engineering, forestry, space navigation, agricultural science, pharmacy among others. Asimor (2000) emphasized the dependency of science on Physics' relationship and manipulations and therefore concluded in his research that science could not exist without the knowledge of Physics.

Jegede and Adedayo (2013) noted that some of the objectives of studying Physics include, among others to provide basic literacy in Physics for functional living in the society and to acquire essential scientific skills and attitudes as a preparation for the technological application of Physics. The concepts learnt in Physics contribute immensely to the technological infrastructure needed to make scientific advancement and discoveries (Aiyelabegan, 2003). Thus, for national development in the areas of science and technology to be achieved, basic concepts and principles of Physics are indispensable.

According to Ajayi (2008), the teaching of Physics in secondary schools is intended to produce young scientists who would be able to design the technological devices and would make day-to-day activities easier and living more comfortable. It thus implies that Physics is one of the pivotal subjects in technology. Hence, the teaching and learning of this all important subject need serious attention in order to enhance a sustainable educational and technological development in Nigeria.

However, emphasis has recently being on how science, especially Physics, is taught to individuals especially to students than it used to be before. Since the interactive approaches to teaching significantly enhance learning, the choice of teaching strategies to be used depends on some factors such as; the concept to be taught, the targeted audience, available instructional materials, learning environment and the learning objectives to be achieved (Jegede, 2010). Ogwo (2004) asserted that methods of teaching adopted by instructors influence the learners' learning styles and the acquisition of skills, which is greatly needed for science and technology achievements in the society. In the same vein, Opara (2011) in his research indicated that teaching method influences students' achievement in Physics. The use of conventional method to teach Physics students in schools diminished their interest and ability to grasp relevant underlying concepts because this approach encourages the students to be passive, more direction-followers and without personal initiatives (Adodo and Gbore, 2012). The need to overcome the various shortcomings of traditional methods of teaching led to the discovery of the innovative teaching methods which actively involve the students in both classroom and laboratory activities. Examples of such methods are demonstration method, discussion method, inquiry method, project method, excursion/field trip, computer-based method among others.

The use of computers in education has become inevitable due to the rapid development of the information and communication technology. Computer-Assisted Instruction (CAI) has been defined by Collete and Collete (2001) as a method which use computer in learning media, strengthening students' motivation and educational process. It makes the students to learn at their speeds and combine active learning with computer technology. The learning takes place through the students' interaction with the computer and appropriate feedback. Research findings of Adepeko (2018) indicated that CAI enhanced students' achievement in Physics though teachers did not often use it, rather they use lecture methods. Thus, there is the need to try a new teaching strategy in line with global trends of educational technology.

Gender, according to Erylimaz (2004) contributed to poor achievement of students in Physics. However, in contrast to this, Owolabi (2013) revealed that gender is not the major issue in Physics practical work as male and female students performed equally in their practices or experimental work.

Therefore, this work examined the effects of CAI on gender among secondary schools' Physics students in Ondo State.

Statement of the Problem

Generally, poor achievement of students in the science subjects has been a subject of concern to many stakeholders in education. The achievement of Physics students in the external examinations conducted by West African Examination Council (WAEC) were largely disappointing as revealed in the reports of WAEC Chief examiners.

Available evidence shows that not much work has been done on the effect of using Computer-Assisted Instruction (CAI) on academic achievement of Physics students in Nigerian secondary schools. Therefore, the problem of this study is to look at the effect of Computer-Assisted Instruction (CAI) on the academic achievement of Physics students in secondary schools in Ondo State, Nigeria.

Research Hypotheses

For the purpose of this research, the following hypotheses were formulated:

1) There is no significant difference in the performance mean scores of students taught Physics using CAI and conventional method.
2) There is no significant difference in the performance mean scores of male and female students taught Physics using CAI

Research Design

This study employed quasi-experimental non-randomized pre-test post-test control group design. Two groups of students were used for data collection (i.e experimental and control groups). The experimental group was taught using CAI while the control group was exposed to normal classroom instructional method.

Sample and Sampling Techniques

The sample for this study consisted of 200 Senior Secondary School 2 (SSS 2) students drawn from eight secondary schools in Ondo State. In each school, 25 senior secondary school 2 (SSS 2) students offering Physics were randomly selected. Four schools were used as experimental groups while the remaining four schools were used as control groups. While the control groups were randomly selected, the experimental groups were purposely selected.

Research Instrument

Physics Achievement Test (PAT) was used to collect data for this study. The instrument consisted of two sections: A and B. Section A elicited information on students' bio-data such as name of school, class, and sex of the students while section B consisted of 20 multiple choice questions with four options A, B, C and D respectively. Section B focused on measuring the students' performance in Motion and Equilibrium of Forces. The instrument was administered on both the experimental and control groups.

Instructional Package

The Computer Assisted Instruction software titled "Computer Interactive Device (CID)" was developed by the researcher with the assistance of program developer. It was designed in linear form and made to respond to instructions. It consisted of introduction section, presentation of the concepts, question stage and exit. It was an individualized programme which enabled individual to make entries while using it.

The terminologies used to teach in the classrooms were also used in the package. The control group were taught using the conventional method.

Research Procedure

The Physics Achievement Test (PAT) was administered to the students before treatment and from this, pre-test results were obtained. At the treatment stage, students in the experimental groups were taught using the prepared software. This was done with the help of computer technologists and the Physics teachers who were trained to be research assistants. The control groups were taught using the conventional method. After six weeks of teaching, the same instrument was re-arranged and administered to the students.

Results

Hypothesis 1: There is no significant difference in the performance means scores of students taught Physics using CAI and conventional method.

Table 1. t-test analysis of students' performance mean scores of experimental and control groups

Variable	N	Mean	Std. dev	Std. Err.	Df	t	P
Experimental Group	100	24.22	3.70	0.30	98	7.73	0.000
Control Group	100	20.04	2.83	0.24			

The result in Table 1 shows that the students taught Physics using the conventional method had lower mean score of 20.04 less than their counterparts in experimental group (Mean = 24.22). Table 1 shows t_{98} (7.73), P=0.000<0.05). This implies that there is significant difference in the performance means scores of students taught Physics using Computer Assisted Instruction (CAI) and conventional method. Hence, the null hypothesis was rejected.

Hypothesis 2: There is no significant difference in the performance means scores of male and female students taught Physics using CAI.

Table 2. t-test analysis of scores of male and female students exposed to CAI

Variable	N	Mean	Std. dev	Std. Err.	Df	t	P
Male	46	24.00	3.61	0.41	98	0.73	0.619
Female	54	24.44	3.80	0.44			

The result in table 2 shows that male students taught Physics using CAI had mean score of 24.00 while their female counterparts had mean score of 24.44 table also show that t_{98} (0.73), P = 0.619 > 0.05. This implies that there is no significant difference in the performance means scores of male and female students taught Physics using Computer-Assisted Instruction. Hence, the null hypothesis was not rejected.

Discussion

From the result in table 1, a significant difference was discovered in the achievement of students taught Physics using Computer-Assisted Instruction for teaching (experimental group) and those taught using the conventional teaching method. This is in agreement with the work of Bunkure (2007) who believed that Computer-Assisted Instruction enhanced students' achievement in Physics.

The result in Table 2 revealed that there was no significant difference in the performance of male and female students in Physics when they were taught using the Computer-Assisted Instruction method. Hence, gender dichotomy in science is eliminated in this study through the use of Computer-Assisted Instruction. This is in line with the work of Owolabi (2013)

who posited that gender is not the major issue as male and female students performed equally in their practices. On the contrary, it disagreed with Erylimaz (2004) who asserted that gender contributed to poor achievement of students in Physics.

Conclusion

From the findings of this study, it was concluded that the use of Computer-Assisted Instruction was more effective and reliable in teaching Physics than the conventional method (since students who were exposed to Computer-Assisted Instruction performed better than those taught with the traditional approach in the achievement test) and that gender does not influence performance of students when they were subjected to equal amount of activities.

Recommendations

Based on the findings of the study, it was recommended that:

1) Physics teachers should be made to recognize the potentials of Computer-Assisted Instruction and utilize than for better performance of students in Physics.

2) The various education stakeholders should organise training, conferences and workshops for Physics teachers on the use of Computer software to improve the teaching of Physics in schools

3) The school administrators should provide computers and conductive learning atmosphere that will accommodate the use of Computer-Assisted Instruction for effective teaching and learning of Physics to be achieved.

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