

Assessment of the Efficacies of Two Modes of Computer Assisted Instructional Package on Students' Academic Achievement in Physics

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Abstract

This study investigated the efficacies of two modes of Computer Assisted Instruction (CAI) on students' academic achievement in physics in Aguata Education Zone of Anambra State. To achieve the purpose of the study, four research questions were posed and four hypotheses were formulated. The study adopted quasi experimental design, specifically, static-group pre-test post-test design. The population for the study comprised 1124 SS2 Physics student in Aguata Education Zone of Anambra State. Purposive sampling technique was used to sample 352 SS2 Physics students used for the study. The sample was obtained using purposive sampling technique. Physics Achievement Test (PAT) was used to collect data for the study. The instrument was validated by three experts in Department of Science Education. Content validity of PAT was determined using a well constructed table of specification. The instrument was trial tested on a sample of 20 Physics students in Nsukka education zone of Enugu State and reliability coefficient of 0.91 was obtained using Kuder-Richardson 20 (KR-20) formula. The data obtained for the study were analyzed using mean and standard deviation to answer the research questions and analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings revealed that computer assisted instruction was more effective in enhancing students' academic achievement in Physics than computer assisted instruction without animation. There was no significant difference in the mean achievement scores of male and female students in Physics. Thus, it was recommended that Physics teachers should adopt the use of CAI with animation method in their lessons in order to enhance the students' academic achievement in the subject.

Key word: Physics, Computer Assisted Instruction, Gender, Achievement.

Introduction

Physics is one of the compulsory core science subject offered by students in senior secondary schools in Nigeria. It is a science that deals with the study of matter in relation to energy. Physics according to Ike (2002) is the study of laws that

determines the structure of the universe with reference to matter and energy. The objectives of studying physics in Nigerian as stipulated in the New Senior Secondary Physics Curriculum (2008) are to: provide basic literacy in physics for functional living in the society; acquire basic concepts and principles of physics as a preparation for further studies; acquire essential scientific skills and attitudes as a preparation for technological application of physics; and stimulate and enhance creativity.

In spite of the importance and objectives of Physics in Nigeria secondary schools, result of Physics students in external examination still remain poor. This poor performance of students in physics was confirmed by West African Examinations' Council (WAEC) Chief Examiner's report in May/June 2010-2014. According to Chief examiner's report (May/June, 2010-2014), the pass rate at credit level recorded for 2010-2014 are; 43.19%, 48.26%, 47.83%, 51.27% and 40.27% in 2010, 2011, 2012, 2013 and 2014.

However, there are several factors responsible for students' poor performance in Physics. These factors as revealed in the literature include; poor primary school background (Obioma, 2005), lack of interest in the subject and concentration in learning (Okereke, 2006), poor teaching and learning environment (Abakpa & Iji, 2011) and lack of adequate laboratory apparatus (Adeyemo, 2011). Some researchers however, attributed poor performance of students in physics to poor and ineffective method of instruction (Kalijah, 2002; Agommuoh & Nzewi, 2003; Ezeliora, 2004). This is supported by the assertion of Osemwinyen (2009) and Tolu (2009) that poor achievement and retention of students in physics is as a result of poor teaching method. There is need, therefore, to focus research on instructional strategies capable of improving students' achievement and retention in Physics since instructional method adopted by the teacher goes a long way in determining achievement and retention of students. Such an instructional strategy as reported in the literature is Computer Assisted Instruction (CAI) (Golden, McCrone, Walker & Rudd, 2006; Yusuf & Afolabi, 2010).

CAI is the process of using computer in teaching and learning processes. Gana (2013) refers to CAI as virtually any kind of computer used in educational settings including drill and practice, tutorials and simulation. Simulations foster learning and help students to see different aspects of a subject and generalize about it (Akpınar & Ergin as cited in Tekbiyik & Akdeniz, 2010). According to Isiaka, Ezenwa, and Anyanwu (2014), CAI as an instructional strategy has proved effective in integrating different types of media and bringing out a better learning outcome in students. The use of CAI has been empirically proved to enhance students' academic achievement, interest, retention and reduce the boring and abstract nature of Physics (Kuti, 2006; Adegoke, 2010; Gambari, 2010; Adegbija & Falode, 2014; Isiaka, Ezenwa & Anyanwu, 2014). There is no doubt from empirical studies that CAI improves students' achievement, interest and retention in Physics, but

there is no empirical evidence on Physics if the efficacy of CAI is as a result of animation or not since CAI package can be packaged with or without animation.

Animation refers to computerized simulation of processes using images to form a synthetic motion picture (Zahra, 2016). The author further opined that it is a process of putting still images together in a sequence or manner so they will appear one after the other creating the illusion movement. There is need therefore, to investigate the effectiveness of the two modes of CAI (with and without animation) on students' achievement and retention in Physic as well as influence of gender.

Research Questions

The following research questions were posed to guide the conduct of the study:

1. What are the mean achievement scores of students taught Physics using computer assisted instructional package with animation and those taught without animation?
2. What is the influence of gender on students' mean achievement scores in Physics?

Hypotheses

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

1. There is no significant difference in the mean achievement scores of students taught Physics using computer assisted instructional package with animation and those taught without animation.
2. There is no significant difference in the mean achievement scores of male and female students in Physics.

Methods

The study adopted quasi experimental research design. Specifically, non equivalent control group research design. The population of the study comprised of all the SS 2 students in Aguata Education zone of Anambra State. A sample 352 SS2 Physics students was used for the study. The sample was obtained using purposive sampling technique. The instrument used for data collection was Physics Achievement Test (PAT) developed by the researchers. Test blueprint or table of specification was used in preparing the test which was based on the six levels of cognitive domain of Bloom's taxonomy of education to ensure proper content coverage. The test contains forty items (questions) with four options ranging from A-D from where the students are expected to select the answer that best answers the question. The instrument developed was face-validated by three experts drawn from Departments of Science Education (Measurement and Evaluation, and Physics Units) and table of specification was used to ascertain the content validity of the instrument. The reliability of the instrument was established by administering 20 copies of the instrument to 25 SS2 Physics students in Nsukka Education Zone of Enugu State who are not part of the study but shares the same characteristics with

the students under investigation. The reliability coefficient of 0.91 was obtained using Kuder-Richardson 20 (KR-20) formula. The instrument for collection of relevant data was administered to Physics students in the sampled schools before the commencement of the experiment which serves as pretest score. After the pretest, the actual experiment commenced, which started with the training of Physics teachers who were used for the study. The subjects were randomly assigned to two groups (Computer Assisted Instruction with animation and without animation). Mean and standard deviation were used in answering all the research questions while analysis of covariance (ANCOVA) was used in testing the formulated hypotheses at 0.05 level of significance.

Results

Research Question One: What are the mean achievement scores of students taught Physics using computer assisted instructional package with animation and those taught without animation?

Table 1: Mean achievement scores and standard deviation of students taught Physics using computer assisted instructional package with animation and without animation

Two modes of Computer Assisted Instruction (CAI)	N	Pre-test		Post-test		Gain Score
		Mean	Std. Dev	Mean	Std. Dev	
CAI (with animation)	168	18.67	5.67	25.54	5.95	6.87
CAI (without animation)	184	17.84	5.42	23.03	8.24	5.19

Result in Table 1 shows the mean achievement scores of students exposed to two modes of computer assisted instruction (CAI) (with and without animation). From the Table, mean achievement scores of 18.67 and 17.84 with standard deviations of 5.67 and 5.42 were recorded for both CAI with and without animation respectively at the pre-test. However, at the post-test, mean achievement scores of 25.54 and 23.03 with standard deviations of 5.95 and 8.24 were recorded for both CAI with and without animation respectively. Moreover, mean gain scores of 6.87 and 5.19 were recorded for the two groups (CAI with and without animation) meaning that CAI with animation is may be more effective compared to CAI without animation in enhancing academic achievement of students in Physics.

Research Question Two: What is the influence of gender on students' mean achievement score in Physics?

Table 2: Mean and standard deviation of male and female students in Physics achievement test (PAT)

Gender	N	Pre-test		Post-test	
		Mean	Std. Dev	Mean	Std. Dev
Males	183	15.43	6.71	24.54	7.80
Females	169	14.54	5.44	23.88	6.80

From the results of the analysis in Table 2, male students obtained a mean achievement score of 24.54 and a standard deviation of 7.80 while their female counterpart had a mean achievement score of 23.88 and a standard deviation of 6.80. Therefore, male students had a higher achievement mean score than female students at the post test. This can be seen from slight difference of .66 between the two post test achievement mean scores. Therefore, gender may influence students' achievement in Physics.

Hypothesis One: There is no significant difference in the mean achievement scores of students taught Physics using computer assisted instruction package with animation and those taught without animation.

Table 3: Analysis of covariance of achievement mean scores of students taught physics using two modes of computer assisted instruction

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1655.254 ^a	2	827.627	16.758	.000
Intercept	10029.815	1	10029.815	203.087	.000
Pretest	1102.634	1	1102.634	22.326	.000
Method	438.441	1	438.441	8.878	.004
Error	17236.016	349	49.387		
Total	225453.000	352			
Corrected Total	18891.270	351			

a. R Squared = .088 (Adjusted R Squared = .082)

Table 3 shows that teaching method is a significant factor on students' achievement in Physics ($F = 8.878$, $P = .004$, thus, the null hypothesis was rejected. This is because the probability value of .004 is less than the level of significance set at .05. Therefore, the researchers concluded that there is a significant difference in mean achievement scores of students in Physics when exposed to two modes of computer assisted instruction (with and without animation) in favour of those taught with animation.

Hypothesis Two: There is no significant difference in the mean achievement scores of male and female students in Physics.

Table 4: Analysis of covariance of the influence of gender on students' achievement in Physics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1345.731 ^a	2	672.866	13.384	.000
Intercept	9196.972	1	9196.972	182.938	.000
Pretest	1307.537	1	1307.537	26.008	.000
Gender	128.918	1	128.918	2.564	.110
Error	17545.539	349	50.274		
Total	225453.000	352			
Corrected Total	18891.270	351			

a. R Squared = .071 (Adjusted R Squared = .066)

Table 4 shows that gender is not a significant factor in students' achievement in Physics ($F = 2.564$, $P = .110$). This is because the probability value of .110 is greater than level of significant set at .05. Thus, the null hypothesis was accepted and researchers concluded that there is no significant difference between the mean achievement scores of male and female students in Physics.

Discussion

The findings of the study in Table 1 shows that students exposed to CAI with animation method had higher achievement mean score compared with students expose to CAI without animation. The achievement difference was further strengthened by the analysis of covariance in Table 3 which showed significant difference in the mean achievement scores of students taught Physics using computer assisted instructional package with animation and those taught without animation. This implies that CAI with animation significantly enhanced students' achievement in Physics compared to the CAI without animation. This high achievement may be as a result of active and collaborative learning as well as task-based teaching which CAI provides with the addition of visual digital display technology that simulates moving objects on-screen which was made possible through the use of animation. This finding is in agreement with the finding of Adegbija and Falode (2014) whose findings revealed that students taught Physics using Animation-based Cam Studio Instructional Package performed significantly better than those taught without animation. Also in support was the finding of Isiaka, Ezenwa and Anyanwu (2014) who reported significant differences in the post-test mean scores of student taught Solid Geometry using two modes of computer-assisted instructional package.

The result of the findings in Table 2 showed male students had a higher achievement mean score than their female counterparts. Further analysis in Table 4 using analysis of covariance (ANCOVA) revealed no significant difference in the

achievement mean score of male and female students in Physics. That showed that the higher mean achievement score accrued to male students as earlier seen in Table 2 was due to chance factor. This result indicated that CAI with animation method is gender-friendly in enhancing students' academic achievement in Physics. This result is in agreement with the findings of Adegbija and Falode (2014) who reported no significant difference between the mean achievement scores of male and female students taught Physics using animation based CamStudio Physics instructional package.

Conclusion

On the basis of the findings of this study, the following conclusions have been made:

1. The use of CAI with animation significantly enhances students' academic achievement in Physics when compared with CAI without animation.
2. Gender had no significant influence on students' academic achievement in Physics. This implies that the superiority of CAI with animation in fostering academic achievement was uniform for both male and female students.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Physics teachers should adopt the use of CAI with animation method in their lessons in order to enhance the students' academic achievement in the subject.
2. Teacher training institutions should structure and restructure the special methodology course to include CAI with animation. This will enable Physics teachers to be adequately trained on the use CAI with animation.
3. Government in conjunction with other professional associations should organize workshops; seminars, conferences and in-service training on a regular basis to train teachers on the use of CAI with animation since the method have been found effective in enhancing students' achievement.
4. Curriculum planners should include CAI with animation method as one the necessary instructional methods for teaching Physics in senior secondary schools in Nigeria.
5. Government should endeavour to supply computers to schools at all levels of education to enable students and teachers to have access to computers during teaching and learning process.

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