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Welcome to IJE

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INFLUENCE OF GENDER ON THE USE OF COMPUTER ASSISTED INSTRUCTION IN TEACHING SECONDARY SCHOOL PHYSICS STUDENTS IN ILORIN SOUTH

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Abstract

This study investigated the influence of gender on the use of Computer Assisted Instruction (CAI) in teaching secondary school Physics students in Ilorin South. Two research questions were addressed on the influence of gender; on the use of CAI and students' scoring ability. The research was a quasi-experimental type with a design of 2x3 factorial. A total of twenty eight senior secondary school one (SSS1) students were involved in the study. The pretest and posttest were conducted and their scores subjected to Analysis of Covariance (ANCOVA). The findings revealed that there was no significant improvement in the performance of male and female students who were taught using CAI while there was a significant difference in the performance of high, medium and low scorers in favour of high scorers. The finding, therefore recommends teachers should encourage both and female students and also make sure that low scorers participate actively in the teaching and learning of physics using CAI Teachers need to integrate CAI into the teaching/learning process for the better performance of physics students.

Keywords: Computer, Computer Assisted Instruction (CAI), Gender, Scoring Ability, Physics, performance.

Introduction

The importance of physics to the development of any nation cannot be underestimated. Physics is the backbone of any nation's science, engineering and technological development. This is why no student intending to study any of the science and technology related disciplines at the post-secondary school level cannot do without physics. Physics as a science subject, exposes the students to knowledge ranging from the periodic table of elements to the reactions of heavy elements and radio-activity with emphasis on concept formation, learning of scientific principles and the practice of physics reactions and methods (Amuche, Amuche, Bello & Marwan, 2014).

Physics is the only discipline that serves as a pivot for other disciplines. Among the science subjects studied, physics is the scientific sword that cut across all other

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disciplines, because of its uniqueness and approach to solve human problems in the world (Mohammed, 2015). How well students perform in the subject is therefore of major concern to researchers and stakeholders in the field. Altun, Yigid and Alev (2007), used computers and computer supported materials in order to find solutions to the problem of students' poor performance. Computer Assisted Instruction (CAI) can be used for making abstract concepts concrete in teaching physics. Yusuf and Afolabi (2010) posited that there is a plethora of established findings on the instructional value of computer. A study conducted by Cotton (1997) concluded that the use of (CAI) as a supplement to conventional instruction produces higher achievement than the use of conventional instruction alone. The author further noted that computer-based education (CAI and other computer applications produced higher achievement than conventional instruction alone. The use of computer based teaching in physics allows students to visualize abstract concepts that will foster their conceptual understanding (Meltzer & Manivannan, 2002).

Fakomogbon, Omiola, Awoyemi and Mohammed (2014) conducted a study using CAI to teach Mathematics students and concluded there was significant difference in the performance Mathematics students in favor of those who were taught with CAI. Computer Assisted Instructional materials are more effective in developing favorable attitude, and in capturing interest towards learning physics (Azar & Sengulec, 2011). Computer Assisted Instructional materials include but not limited to computer simulations, animations, classroom management software & hardware, tutorial software and so on. Computer simulations seem to be one of the most effective ways to use computers in physics education. The computer simulations prepared to be used in teaching activities are able to create a teaching atmosphere like laboratories where students are active (Perkins, Adams, Dubson, Finkelstein, Reid, Wieman & LeMaster, 2006).

Dancy and Beichner (2006) also opined that Computer animations offer the potential for increased learning when there is a need for external visualization and when the content depends on an understanding of motion. The visual observation of the physical processes on computers will help the students to consolidate the knowledge gained and find ways to link this to their real world situations. The computer environments provide students a platform to apply their knowledge in a given situation which will result in the discovery of new knowledge (Kocakaya & Gonen, 2010).

Fakomogbon et al (2014) in their study noted that male and female students were affected positively and equally by the use of CAI package in teaching Mathematics. They concluded that the effect of CAI package is not gender dependent. Aina (2013) also noted that male students perform better than female students in practical Physics. Computer software such as classroom management software and virtual laboratory can be used for this study to improve students' performance in Physics examinations.

Statement of the problem

Several studies have revealed the

Research Objectives

The main purpose of the study was to investigate the influence of gender on the use of Computer Assisted Instruction (CAI) in teaching secondary school physics students in Ilorin South. Specifically, this study examined:

1. The influence of Students' gender on their scores in Physics, when Computer Assisted Instruction (CAI) method is used in teaching.
2. The influence of students' gender and scoring ability, when Computer Assisted Instruction (CAI) method is used in teaching.

Research Questions

The following questions were raised and answered

1. Does gender influence the performance of students when taught with Computer Assisted Instruction (CAI)?
2. Does gender has any influence on the performance of the high scoring ability, medium scoring ability and low scoring ability students

Research Hypotheses

The following hypotheses were formulated and tested in this study;

- H₀₁ There is no significance difference between the performance of male and female students when taught with (CAI) method.
- H₀₂ There is no significance difference between the performance of male and female students with high scoring, medium scoring and low scoring abilities when they are taught with (CAI) method.

Methodology

The nature of the research was experimental. The study adopts a quasi-experimental type of pre-test, post-test non-equivalent and non-randomized 2 x3 design. The study designed was grouped into gender (2 levels) male and female, and (3 levels) for scoring ability (low scorers, medium scorers and high scorers).

An intact class of twenty eight (28) students, comprising of fifteen (15) males and thirteen (13) females were engaged for the study. The sampled school was purposively selected based on the availability of functional computers necessary for the study.

The instruments used for the research were "Smart Sync" (a classroom management software), "Computer Assisted Instructional Package on the concept of Motion (CAIM)" and a test instrument, "Physics Performance Test (PHYPET)". The treatment instrument, Computer Assisted Instructional Package on the concept of Motion (CAIM), was developed by the researchers. The content of the package was based on the content of the senior secondary school one (SSS1) physics syllabus on motion. The software involved, "Smart Sync", makes it possible to disseminate instruction to the learners in the class through the use of sets of computer systems. All the computers in the class were either wired or wirelessly connected together through a network. A good

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network was ensured for better performance of the software. If the network is not in good shape, the computers will not be able to communicate with each other effectively. The teacher's version of the software was installed on the teacher's computer while the students' version was installed on each of the students' computers. Computer Assisted Instructional package on the concept of motion (CAIM) was presented to the students through Smart Sync. The test instrument, Physics Performance Test (PHYPET) is a twenty five (25) items multiple-choice objective test prepared by the researchers based on the concept of motion.

The research instruments were pilot tested and found to satisfy face, content and construct validity by three lecturers in the Department of Science Education and Educational Technology, University of Ilorin, who are experts in the principles of instruction. Difficulty index was carried out on the test items to arrive at 25 test items. The reliability constant of the test was determined using the Kuder-Richardson (KR-20) method and was identified as 0.6 reliability index.

PHYPET was administered to the students to ascertain their pre-knowledge of what they are to be taught. After the pretest, they were taught the concept of motion using CAI as a medium of instruction with Smart Sync software, which had already been installed on all the students' computers. When they are not expected to do anything on the computer, the teacher sends a command that prompt students to focus their "eye to the front of the classroom please". Activities like watching of short video clips, animation, etc. on the lesson were also included in the presentation of the CAIM.

After the duration of four weeks of treatment, PHYPET was administered to them again as posttest. The results of the tests were used in the data analysis. The scores obtained were analyzed using analysis of covariance (ANCOVA).

Results

Hypothesis One: There is no significance difference between the performance of male and female students when taught with Computer Assisted Instruction (CAI) method. The result obtained from the testing of hypothesis one is as shown in table 1.

Table 1: Analysis of Covariance of Mean Scores of Male and Female Students taught with CAI.

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Corrected Model	1957.515	2	978.757	62.117	0.00
Pretest	1955.050	1	1955.050	124.079	0.00
Sex	0.196	1	0.196	0.012	**0.912
Total	124848.000	28			
Corrected Total	2351.429	27			

** denotes F is not significant at 0.05 alpha level

Table 1 shows that an $F(1, 27) = 0.012$, and the $\alpha = 0.912$ for the influence of gender was not statistically significant at 0.05 alpha level. This is because the significance of F , $\alpha = 0.912$ is greater than the 0.05 alpha level of significance. This study therefore retained the null hypothesis H_{01} . The result shows that gender did not affect the performance of the group of students taught with Computer Assisted Instruction (CAI), as the performance of male students did not differ significantly from that of their female counterparts when both were taught using CAI methodology.

Hypothesis Two: There is no significant difference between the performance of male and female students with high scoring, medium scoring and low scoring abilities when they were taught with Computer Assisted Instruction (CAI) method. The results obtained from the testing of this hypothesis are presented in Tables 2a, 2b and 2c.

Table 2a: Analysis of Covariance of the Mean Scores of male and female high scoring ability Students

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Corrected Model	223.656	2	111.828	8.258	0.254
Pretest	202.323	1	202.323	4.055	0.137
Sex	.184	1	.184	.004	**0.955
Total	37504.000	6			
Corrected Total	373.333	5			

** denotes F is not significant at 0.05 alpha level

Table 2a shows that an $F(1, 5) = 0.004$, and the $\alpha = 0.955$, for the male and female high scoring ability students, was not statistically significant at 0.05 alpha level. This is because the significance of F , $\alpha = 0.955$ is greater than 0.05 alpha level of significance. This is an indication that the use of Computer Assisted Instruction (CAI) in teaching improves the performance of both male and female high scoring students equally.

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Table 2b: Analysis of Covariance of the Mean Scores of male and female low scoring ability Students

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Corrected Model	315.283	2	157.641	15.158	0.000
Intercept	558.511	1	558.511	53.703	0.000
Sex	5.648	1	5.648	0.543	**0.472
Total	71792.000	19			
Corrected Total	481.684	18			

** denotes F is not significant at 0.05 alpha level

Table 2b shows that an $F(1, 18) = 0.543$, and the $\alpha = 0.472$ for the male and female low scoring ability students was not statistically significant at 0.05 alpha level. This is because the significance of F, $\alpha = 0.472$ is greater than 0.05 alpha level of significance. This is also an indication that both male and female students learn equally when Computer Assisted Instruction (CAI) was used in teaching.

Hypothesis Two: There is no significance difference between the performance of high scoring, medium scoring and low scoring levels students when they were taught with Computer Assisted Instruction (CAI) method.

Table 2c reveals that an $F(2, 27) = 21.877$, and $\alpha = 0.000$ for the scoring level of students taught with Computer Assisted Instruction (CAI) was significant. This is because the significance of F, $\alpha = 0.000$ is less than 0.05 alpha level of significance. The result shows that the mean scores of the posttest of the high scoring, medium scoring and low scoring level students were significant. The study therefore rejects the null hypothesis H_{O2} .

Table 2c: Analysis of Covariance of the Mean Scores of the High, Medium and Low scoring level Students.

Source of Variation	Sum of Squares	Df	Mean Square	F	Significance of F
Corrected Model	1496.411	2	748.206	21.877	0.000
Intercept	81273.406	1	81273.406	2376.367	0.000
Scoring Level	1496.411	2	748.206	21.877	*0.000
Total	124848.000	28			
Corrected Total	2351.429	27			

* denotes F is significant at 0.05 alpha level

In order to locate where the significant difference existed among the High Scorers, Medium Scorers and Low Scorers, a Scheffe test was conducted. The result is as shown in Table 2d that there was significant difference in the mean scores of High Scorers and Low Scorers in favor of the Low Scorers. It also indicates that significance difference exists in the mean scores of the Medium Scorers and the Low Scorers in favor of the Low Scorers. This is an indication that the Low Scorers benefited most as their mean score was significant when compared with their high and medium scoring counterparts.

Table 2d: Scheffe Test of Significance on the Mean Scores of the High, Medium and Low scoring students

Scoring Level	Mean Scores	High	Medium	Low	School C.A. Mean
High Scorers	78.667		0.290	*0.000	78.33
Medium Scorers	72.000	0.290		*0.024	60.00
Low Scorers	61.263	*0.000	*0.024		29.47

* denotes the mean difference is significant at 0.05 alpha level
2351.429

Discussion of Findings

The findings of the study reveals that, the students who were taught using Computer Assisted Instruction (CAI) performed better. This is in support of the conclusion of Fakomogbon et al (2014) that there was significant performance in Mathematics in favor of students who were taught with CAI. It is also in consonance with the assertion of Tambade and Wagh (2011) that Computer Assisted Instruction was pretty much effective than traditional teaching in students' achievement in physics.

The result also showed no significance difference in gender influence for the students taught with CAI. This is in line with the findings of Spence (2004) that there is no significant influence of gender on the achievement of college students in Mathematics when they were taught with Mathematics courseware in online and traditional environment. It is also in support of the findings of Fakomogbon et al (2014) that male and female students were affected positively and equally by the use of CAI package in teaching Mathematics.

Conclusion

From the findings of this study, the use of Computer Assisted Instruction (CAI) in teaching positively influenced the performance of secondary school physics students in Ilorin south local government area. It was found that students are more fascinated and prepared to learn when they are taught with CAI. Their performance greatly improved, assimilation and reminiscence of concepts become easier as they learn by exercising various senses..

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The study also revealed that gender has no influence on the performance of secondary school physics students. The use of (CAI) enhances the performance of both male and female students. It was therefore, deduced that the use of Computer Assisted Instruction enhances the performance of both male and female students.

Recommendations

The following recommendations are hereby made based on the findings of the study;

1. Computer Assisted Instruction (CAI) should be incorporated into the teaching-learning process in order to solve the problem of gender learning imbalance. The use of CAI improves the performance of both male and female students equally.
2. Computer Assisted Instruction (CAI) should also be used in teaching in classes with special students. It gives special students the opportunity of learning in a better way that improves their performance. Low scoring students have the chance of rising to medium or high scoring level when they are taught with CAI.
3. School administrators should ensure that computers are made available for all students and teachers in their schools. If possible a personal computer should be allotted to each student and teacher.
4. Information Technology (IT) experts in schools should ensure good network of the teachers' and students' computers and ensure the installation of the classroom management software on all the computers for easy communication and monitoring. The IT experts in the schools should assist the teachers and students by training them the basic knowledge of computer and CAI as instruction.
5. Government should ensure that computer systems are made available in schools for teachers and students use.

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