Gender and Academic Retention of Secondary School Students Taught Electrostatics with Computer Animated Instructional Package in Awka Education Zone

**1Nwoye, A. N., 2Okeke, S. O. C. & 3Nwosu, F. C.**

***1, 2****Department of Science Education, Nnamdi Azikiwe University Awka, Anambra State, Nigeria*

***3****Department of Electrical/Electronic Engineering, Federal Polytechnic Oko, Anambra State, Nigeria*

*1* [*an.nwoye@unizik.edu.ng*](mailto:an.nwoye@unizik.edu.ng) *2* [*soc.okeke@unizik.edu.ng*](mailto:soc.okeke@unizik.edu.ng) *3* [*jirebus@gmail.com*](mailto:jirebus@gmail.com)

Abstract

*Several researchers had investigated how multi-media could be used to improve understanding of difficult and abstract topics in physics yet; a few studies have been conducted to investigate the gender differences in students’ learning retention through multi-media use. This paper determined gender differences in students’ academic retention in electrostatics through computer animated instructional package (CAIP)in Awka Education Zone. of Anambra state, Nigeria. One research questions guided the study and two null hypotheses were tested at 0.05 level of significance. Quasi-experimental non-equivalent control group design was adopted for the study. Population was 3,438 senior secondary one (SS I) students from government owned co-educational secondary schools in the area. A sample of 68SS I from Awka south and Dunukofia Local Government Areas was selected through multistage sampling. The students were exposed CAIP produced by the researchers which is based on the content of the SS I physics scheme of work. Instrument for data collection was Electric Charge Electric Field Achievement Retention Test (ECEFART) validated by three experts with a reliability index of 0.89 using KR-20 formula. Mean and Analysis of covariance were used for data analysis. Findings revealed that; gender had no significant influence on students’ retention in electrostatics when taught with CAIP; there was no significant interaction effect of treatment and gender on students’ academic retention. Based on the findings, it was recommended among others that since computer animated package enhances retention in physics, teachers should embrace its usage in classroom.*

**Keywords:** Gender, retention, electrostatics, Computer assisted instruction

Introduction

The importance of education across gender has led to the intensified research on the performance of both male and female students in academics in addition to the need to ensure an equal performance of both genders on both science and art subjects. It has also called for the need to identify the factors leading to the differences in their academic performance where there is any. Several authors have noted the influences of teacher’s competence, family background of the students, school environment, the society where the school exists and the impact of government on the retention and performance of students on science subjects such as Physics (Akiri & Ugborugbo, 2014; Ayodele & Adebiyi, 2013; Okoro, 2004). However, Adigun et al (2015) identified that gender is a strong influencing factor in the retention and performance of students in science subjects and their understanding of difficult science concepts. According to the authors, a student’s gender comprises the physical, mental, biological features of an individual including the behaviours that make the male and the female population distinct. The need for the study of the effect of gender on the student’s academic retention is underpinned by the socio-cultural dissimilarities between both genders. For instance, some science/technological professions such as carpentry, engineering, craft are classified as men’s professions while some professions such as catering, nursing, and home economics are classified as a female course based on the socio-cultural perspectives of the individual.

To enable students' understanding of the teaching and learning process and to increase students’ retention in perceived difficult science concepts such as Electrostatics, computer technology is applied to facilitate students' understanding. Electrostatic is a concept in physics which studied charges at rest. The realization that this aspect of physics is among those that is treated as a difficult and abstract concept with little practical implications has over time dampened interest of the learner hence retarding their retention of the concept which equally affects their performance in physics. Yusuf and Afolabi (2010) noted that the Computer Animated Instructional Package (CAIP) arouses the interest of the students thereby enhancing retention and serves as a motivation to the students irrespective of their gender. Through the CAIP lessons are provided for better understanding through, animation, games, drill and practice, visual imagery, and tutorial (Mayer, 2009; Scot, 2004). Students' ease in understanding a lesson serves as a driver for their sustained attention and retention in the subject and the subsequent adoption of the subject as a career choice because of the simple method the lessons are presented through the CAIP.

Several studies have been carried out to ascertain the effect of gender on the understanding, performance, and retention of the student in some science subjects such as Mathematics, Computer, and Physics using computer-animated instruction package, however, Yusuf and Afolabi (2010) identified that there has not been any success recorded as the link between the instructional model and the performance of either male or female gender, but the authors believed that attitude to the model, access, computer use, and career choice is not the same across genders. This has called for the concern of parents, policymakers, practitioners, and stakeholders in education on ensuring equal perception of the importance of advanced technology, because of its future position in human activities such as teaching and learning. Scholars such as Danmole (1998) and Stephen (2010) were of the view that male students outperform female students in a science subject such as Physics while other study carried out by Atadoga, Zaria, Mari,and Danjuma (2016) made a contrary revelation stating that female students perform better than their male counterparts.

On the use of the CAIP, Collazos, Guerrero, Llana, and Oetzel (2020) identified that computer-animated instructional model improves collaborative learning which also ensures students’ performance and retention in some perceived difficult subjects such as Physics. The authors identified that a greater number of females in a collaborative learning group have a higher index of collaboration when compared with a group with few numbers of women. Research across genders failed to establish the gender-differences across on the retention of male and female students. Authors such as Kirkpatrick and Cuban (1998) and Yusuf and Afolabi (2010) stated that findings have revealed a similar record across genders when male and female students are exposed to the same level of learning experience using the CAIP, therefore a similar level of impact is recorded in students-subject retention across gender.

Purpose of the Study

The main purpose of the study is to investigate on the influence of gender on the academic retention of secondary school students taught electrostatics with Computer Animated Instructional Package (CAIP). Specifically, the study sought to;

1. investigate the difference in mean retention scores of male and female students taught electrostatics using CAIP.
2. find out the interaction effect of the package and gender on students’ retention in electrostatics.

Research Question

1. What is the difference in mean retention scores of male and female students taught electrostatics using CAI package?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean retention scores of male and female students taught electrostatics.
2. There is no significant interaction effect of package and gender on students’ retention in electrostatics.

Method

Quasi-experimental design was used for this study, specifically, non-equivalent control group design. The population is total of 3,438 SS 1 students from all the state government owned co – educational secondary schools in Awka Education Zone of Anambra state. Co-educational secondary schools were chosen in order to create the same study environmental condition for both genders. While SS 1 students were chosen because SS 1 is the foundation class for science students and if captured at that level the students might likely study physics in SS 2 and SS 3. The sample was made of 68 (37 males and 31 females) SSI students. This was selected through multistage sampling. 30 items of multiple-choice questions (MCQ) on electric charge and electric field were used as data collection tool. Prior to the classroom exercise, teachers who acted as research assistants had been adequately briefed and had demonstrated competence in the successful implementation of the instructions, pre-test was applied on groups a week before the actual teaching of the electric charge and electric field concepts. Experimental groups were taught using CAIP. Conventional lecture method was used for groups which are known as control groups. Post-tests were administered to both groups one week after the treatments. In analysis of data, descriptive and inferential statistics were used. ANCOVA was used for testing the hypotheses. In this case, post-test scores serve as covariate measures. In this study, steps below were observed with control and experimental groups in 5 weeks of process. At the end of pre-test, subjects of electric field, types of charge, charge and charge interaction, charge as a quantity and production of charges were taught to both groups by their class teachers who served as research assistants in line with the lesson plan prepared by the researchers. Control groups were exposed to the physics concepts using conventional method. Experimental groups were taught using CAIP produced by the researchers from the same field with the lesson plan. The package adopted the tutorial modes of Computer Assisted Instruction (CAI). After the treatment has been made, the same instrument was reshuffled and used as delayed post-test.

Results

**Table 1: Mean and Standard Deviation Scores of Students’ Retention Scores by Gender**

**Post-test Test for Retention**

**Gender N Mean SD Mean SD Gain in mean**

Male 37 73.00 10.21 74.92 8.54 1.92

Female 31 70.10 10.87 75.23 12.56 5.13

Mean Difference 2.90 -0.31 -3.21

Table 1 presents the mean retention scores of male and female students exposed to CAIP in electrostatics. Male students had a mean retention score of 74.92 while their female counterpart had 75.23. From the table 1, it is obvious that female students with mean gain of 5.13 retained more than male student with mean gain of 1.92.

**Table 2: ANCOVA Test of Significant Difference between the Mean Retention Scores of Students by Gender**

Type III Sum Mean

Source of Squares df Square F Sig. Decision

Corrected Model 1590.331a 2 795.165 8.962 .000

Intercept 2424.523 1 2424.523 27.325 .000

Post-test 1588.742 1 1588.742 17.905 .000 S

Gender 45.690 1 45.690 .515 .476 NS

Treatment\*Gender 351.790 1 351.790 3.019 .084 NS

Error 5767.434 65 88.730

Total 390458.000 68

Corrected Total 7357.765 67

S= Significant at 0.05 probability level NS= Not Significant at 0.05 probability level

Table 2 reveals that the value of significant of F (0.515) on the mean retention scores of students based on gender (Treatment\*Gender) is 0.476 which is greater than the alpha level of p<0.05. The null hypothesis that there is no significant difference between the mean retention scores of male and female students taught electrostatics through CAIP is therefore upheld. This implies that the effect of CAIP on students’ retention does in no way influenced by whether the student is a male or female.

From Table 2, it can be observe that the significant of F (3.019) for the interaction (Treatment\*Gender) is 0.084 against p˂0.05. Facts emerging from the table show that there is no significant interaction effect between method of instruction and gender on students’ retention. Thus, the null hypothesis 2 is upheld. That means the male and female students are in the same retention level when exposed to CAIP.

Discussion

The findings of this study revealed that there is no variance in the delay post ECEFAT scores of male and female students exposed to CAIP. This is an indication that male and female students benefitted. Table 2 also confirms that gender is not a significant factor in students’ retention in physics concept taught. This is in agreement with the earlier findings of Aminu (2015); Stephen (2010) which revealed no significant difference in the academic retention of male and female students exposed to animated-media strategy. The present study further reveal that CAIP used in the course of this study could be used to improve students’ retention in physics irrespective of gender.

Hypothesis two predicted that there would be no significant interaction effect of the package and gender on students’ academic retention in electrostatics. But the result of the analysis of covariance on retention presented on Table 2 showed that the significance of F in the two-way interaction is higher than the significant level of alpha set at p<0.05. It implies that there is no significant interaction effect of method of instruction and gender on students’ retention in physics concept (electrostatics). This means that the group difference is not sensitive of gender.

From the findings of this study, CAIP has proved to be useful in teaching and learning of physics in Awka Education zone, Anambra state, Nigeria just as in developed countries of the world like; USA, UK and so on. The realization that physics is treated as a difficult and abstract subject with little practical implications has over time dampened interest in the learning of physics thereby hampering students’ retention in physics. However, with the emergence of ICT as an important tool in teaching and learning of science which physics is one of the science subject, teaching and learning of difficult and so to say abstract subjects like physics has proven not to be inherently boring. Looking at it from another angle, it can be said that the problem lies in the fact that teachers are usually not equipped with the skillset and tools to make the teaching and learning of physics more interesting. This concur the expression of Aina (3013) that the proliferation of educational software aimed at explaining the complex aspects of physics have served to trigger interest in the subject. With the students’ interest aroused in any educational environment, there retention will automatically be enhanced. Hence with the use of computer software (CAIP, CAD, CAI, among others) in classroom activities, teaching and learning of not only physics but other difficult subjects’ concept will become more interesting, simplify and meaningful thereby enhancing retention of learners.

Conclusion

Based on the findings of this study, the following conclusions were made. The result of this study provide empirical evidence that female students exposed to CAIP retained slightly more than their male counterparts, though their mean retention scores were not significant.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. Students irrespective of gender should have equal opportunity and the level of motivation to learn.
2. Since the use of computer animated instructional package enhances retention in physics concept (electrostatics), the physics teachers should embrace its usage in classroom.

References

Abimbade, A. (1997). *Principle and practice of educational technology*. Ibadan: International Publishers Ltd.

Adigun, J., Onihunwa, J., Irunokhai, E., Sada, Y. and Adesina, O. (2015). Effect of gender on students’ academic performance in computer studies in secondary schools in New Bussa, Borgu Local Government of Niger State. *Journal of Education and Practice, 6(33),* 1-7.

Aina, J. K. (2013). Effective teaching and learning in science education through ICT. *IOSR-JRME, 2(5),* 43-47

Akiri A. A. and Ugborugbo, N. M. (2009). Teachers’ effectiveness and students’ academic performance in public secondary schools in Delta State, Nigeria. *Stud Home Comm Sci, 3(2),*107-113*.*

Atadoga, M.M, Zaria, A.B, Mari, J.S & Danjuma, A.B (2016). Effects of CAI on academic achievement of Nigeria certificate in education physics students in Niger state, Nigeria. *Report and opinion, 8 (1),* 39 – 46.

Ayodele, C.S & Adebiyi, D.R (2013). Study habits as influence of academic performance of university undergraduates in Nigeria. *Research Journal in Organizational Psychology & Educational Studies, 2(3),*72-75*.*

César A. Collazos, C. A., Guerrero, L.A., Llaña, M. & Oetzel, J. (2020). Gender: An influencing factor in the collaborative work process in computer-mediated communication. Retrieved from*:* [*https://www.researchgate.net/publication/255628731\_Gender\_An\_influence\_factor\_in\_the\_collaborative\_work\_process\_in\_computer-mediated\_communication*](https://www.researchgate.net/publication/255628731_Gender_An_influence_factor_in_the_collaborative_work_process_in_computer-mediated_communication).

Danmole, B. T. (1998). The influence of teacher preparation and use of instructional materials on primary school pupils’ performance in integrated science. *Ilorin Journal of Education, 12,* 56 - 64

Kelly, A (1978). *Girls and science.* International Association for Evaluation of Educational Achievement Monograph (9). Stockholm: Almguist and Wilksell.

Kirkpatrick, H. & Cuban, L. (1998). Should we be worried? What the research says about gender differences in access, use, attitudes, and achievement with computers*. Educational Technology, 38 (4),* 56 – 60.

Novak, J. D. & Mosunda, D. (1991). A twelve-year longitudinal study of science concept learning. *Americana Research Journal, (28),* 117 - 153

Okoro, C. N. (2004). *School environment and teacher competency variable as correlates of learning outcomes of integrated science students with hearing impairment.* Unpublished Ph.D. Thesis University of Ibadan, Ibadan.

S.A. Awoniyi, (2004). Sex differences in academic performance. *Nigerian Journal of Gender and Development,1(1&2)* 35.

Scott, M. (2004). *Wordsmith Tools 4*, Oxford: Oxford University Press.

Wonzencreft, M. (1963). Sex comparism of certain abilities. *Journal of Educational Research 57, 21 – 22*

Yusuf, M. O. & Afolabi. A. O. (2010). Effects of computer assisted instruction (CAI) on secondary school students’ performance in biology. *Turkish Online Journal of Educational Technology, 9(1), Retrieved from:* [*www.tojet.com*](http://www.tojet.com)*.*

Yusuf, O. M. & Afolabi, O. A. (2010). Effects of computer assisted Instruction (CAI) on secondary school students’ performance in Biology. *The Turkish Online Journal of Educational Technology, 9(1),* 62-69.