

EFFECTS OF COMPUTER ASSISTED INSTRUCTIONAL PACKAGE ON GENDER
ACHIEVEMENT AND RETENTION IN GEOMETRY AMONG JUNIOR
SECONDARY SCHOOL STUDENTS IN MINNA METROPOLIS

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Abstract

This study examine the effectiveness of Computer- Assisted Instructional package (CAIP) on gender achievement and retention in geometry among junior secondary school students in Minna Metropolis. Three research questions were raised and three null hypotheses were formulated. The study adopted the pre-test-posttest - control group design. A random sample of eighty (80) students was drawn from four junior secondary schools in Minna Metropolis. The researcher developed computer assisted instructional package on geometry which was used as treatment instrument for experimental group. The instrument for data collection was Geometry Achievement Test (GAT). A 40-items multiple-choice objective type achievement test covering ten selected topics in Geometry was used to collect data. A reliability coefficient of 0.75 was obtained from test-retest data using Pearson's Product Moment Correlations coefficient. The t-test statistic was used to analyzed the data. The findings revealed that male students performed better than female students when taught geometry with CAI. It was recommended among others that there should be the provisions of adequate teaching and learning materials particularly those that have to do with information and communication technology by the government or other relevant stakeholders in order to improve the use of computer devices for meaningful learning of mathematics.

Keywords: Computer Assisted Instruction, Achievement, Retention, Gender and Geometry

Introduction

Progressive education in science, technology and mathematics for male and female citizens is the most effective developmental investment any society can make to attain social stratification with high powered technological advancement. Mathematics is central to this development and it is an intellectually stimulating subject that affects every facets of human activity such as politics, economy, science and technology. Salman (2005) describes it as a precursor of scientific discoveries and inventions. Mathematics is the science of space and numbers (Odili, 2006). The study of space is called Geometry; the study of numbers is called Arithmetic, while the hybrid of Geometry and Arithmetic is called Algebra. For proper understanding of science, mathematics play a major role, hence is referred to as the queen of all sciences (Odili, 2006). In another development, Abdullahi (2004) observed that among the factors contributing to students' low enrolment and performance in physics is poor mathematical ability.

The importance of mathematics is underlined by the fact that it is a compulsory subject and a basic requirement for admission into tertiary institutions for any course of study in Nigeria. According to Punch (2004), the subject is needed for technological development of Nigeria and that the future of national industrial and technological development hinges on Mathematics,

which is regarded as the pillar of science and technology. Nigeria is facing an uphill task in producing requisite engineers, scientists and technologists as a result of poor base for Mathematics to thrive. Therefore, Geometry is an important component of mathematics that deals with the study of spatial relationship. It is connected to every strand in the mathematics curriculum and to a multitude of situations in real life (Naidoo, 2009). Geometric figures and relationships have played an important role in the society, especially in things that are aesthetically pleasing. Well-constructed diagrams allow us to apply knowledge of geometry, geometric reasoning, intuition to arithmetic and algebraic problems. The use of a rectangular array to model the multiplication of two quantities, for instance, has long been known as an effective strategy to aid the visualization of the operation of multiplication. Other mathematical concepts which run very deeply through modern mathematics and technology, such as symmetry, are most easily introduced in a geometric context. Whether one is designing an electronic circuit board, a building, a dress, a bookshelf or a newspaper page, an understanding of geometric principles is required (Naidoo, 2009)

In spite of the importance and popularity of mathematics among Nigerian students, performance at junior secondary school level had been poor (Iwendi, 2012). The major problems faced by most students are the inability to remember what they have learnt. This problem is often caused by too much theoretical expressions or formulae by the mathematics teachers while learners remain passive listeners (Odili, 2006). Therefore, to remove passiveness and ensure smooth interaction in the classroom, Computer Assisted Instruction package could be used to transform Mathematics classroom in to different kinds of rich memorable experiences and thus reduce boredom and forgetfulness.

Retention is an act of retaining something or the condition of being retained, or ability to remember things. In relation to teaching and learning, it means the act of remembering what has been taught in the classroom. Correct and effective use and/or application of whatever one had learnt would aid retention Mkpa (1981) states that retention is the continued capacity to behave in particular way that has been learned. Also Obodo (1990) asserts that retention is measured in collaboration with achievement. His study on differential effects of three teaching models on performance of Junior Secondary School students in some algebraic concepts showed equal retention. This indicates that each of the models, that were effective in students' achievement in algebra, could as well help the students to retain algebraic concepts effectively. Eze (2002) therefore, posits that retention is a crucial construct that most classroom teachers strive to maximize among their pupils.

Gender issues have been linked with performance of students in academic task in several studies but without any definite conclusion. Odok (2006) found that there is no significant relationship between gender and achievement in number and numeration, statistics and algebra, but a weak relationship between gender achievement in geometry and trigonometry. Also, Amelink (2009) indicated that male students performed better in geometry and measurement, while numbers and operations were better handled by female students.

Mathematics at all levels of Education especially junior secondary schools continues to remain a serious problem to students due to the abstract nature of the subject. This has led to high rate of failure in public standardized Examinations (WAEC/NECO) in secondary schools. The lack of understanding in learning geometry often causes discouragement among the students, which invariably lead to poor performance in geometry. A number of factors have been put forward to

understand why geometry learning is difficult, these are geometry language, visualization abilities, and ineffective instruction (Cangelosi, 1996) in Alhassan (2013)

However, as a result of the above backdrop the researcher found it necessary to search for appropriate approach that will be suitable and may enhance academic achievement and retention in geometry. Thus, this study examine the effects of Computer Assisted Instructional package on male and female students' achievement and retention in Geometry among Junior Secondary School Students in Minna metropolis, Niger state

Purpose of the Study

The purposes of the study are to:

- (i) examine the effect of computer assisted instructional package on student's achievement in geometry between the experimental and control groups
- (ii) examine the influences of gender on the academic achievement of students when taught geometry using Computer Assisted instructional package.
- (iii) find out the influence of gender on the mean retention score of students taught geometry using Computer Assisted instruction Package.

Research Questions

The following research questions are addressed in the study:

- (i) Is there any difference in the mean achievement scores of students taught geometry using computer assisted instructional package and those taught the same geometry using lecture method?
- (ii) Will there be any difference in the mean achievement scores of male and female students taught geometry with Computer Assisted Instructional package?
- (iii) Will there be any difference in the mean retention scores of male and female students taught geometry using Computer Assisted Instructional package?

Null Hypotheses

The following null hypotheses were tested at 0.05 alpha levels:

- HO₁: There is no significant difference in the mean achievement scores of students taught geometry with computer assisted instruction and those taught with lecture method.
- HO₂: There is no significant difference between the mean achievement scores of male and female students taught geometry using CAI package.
- HO₃: There is no significant difference between the mean retention scores of male and female students that are taught geometry using CAI package.

Methodology

The research design for this study was a pretest-posttest control group design. The target population was 4,383 secondary school students in Minna Metropolis, Niger state. Simple random sampling technique was adopted to select four junior secondary schools for experimental and control groups, out of twenty (20) public schools in Minna Metropolis. Hat-draw method was used in the selection process.

The sample for this study was made up of 80 students, boys (n=40) and girls (n=40) using stratified random sampling techniques. A breakdown revealed that the experimental group

consist of 40 students with an equal gender balanced of boys ($n=20$) and girls($n=20$). The experimental groups was taught geometry using Computer Assisted Instructional package (CAIP) which covered ten topics

The research instrument for data collection for the study was Geometry Achievement Test (GAT). This is an achievement test drawn from past Junior Secondary School Certificate Examination/National Examination Council (JSSCE/NECO) question papers (2006-2011). The test consisted of forty (40) multiple choice questions with four options. The test carried a total of one hundred (100) marks, with each correct answer weighed 2.5 marks. The topics taught during the study were introduction to geometry, quadrilateral, polygon, Areas of plane shapes, Areas of Triangle, Areas of Rectangle, Areas of Parallelogram, Sum of interior Angle of a polygon, Surface area of a Cylinder and Surface area of a Cone. The instruments for this study are Geometry Achievement Test (GAT) and Computer Assisted Instructional package (CAIP).

Computer Assisted Instructional package (CAIP) on geometry is a self-instructional and interactive package. It contained ten lessons structured in units, each unit lasted 40 minutes. The topics covered in the package were introduction to geometry, quadrilateral, polygon, Areas of geometric shapes, Areas of Triangle, Areas of Rectangle, Areas of parallelogram, Sum of interior angle, surface area of a Cylinder and surface area of a cone. The topics were drawn from the geometry contents of Nigerian junior secondary school Mathematics curriculum for JSSII.

The computer Assisted Instructional Package (CAIP) and Geometry Achievement Test (GAT) were validated by three (3) experts from mathematics/computer department and two mathematics teachers from junior secondary schools in Minna metropolis validate the contents of the instruments. They considered the audibility, simplicity of the package as well as its suitability for the level of the subjects. They verified the extent to which the items of each unit were considered to testing the topic they were meant to test, and check the possible errors and suggested answers. Base on the comments, corrections and advise of the experts, the original package was edited by the researcher for the final draft. The package, thus validated was then used for the study. A pilot test was conducted using test-retest method to ascertain the reliability of the Geometry Achievement Test instrument. The instrument had reliability coefficient of 0.75 using Pearson Product Moment Correlation coefficient

The study covered six (6) weeks. There was an orientation with the mathematics teachers and the students in each sampled school. This training and demonstration lasted for a week. When the teachers and students were adequately briefed, trained and have demonstrated competency on operational guide to instruction, the study then commenced. The experimental groups were exposed to Computer Assisted Instructional package which had been installed on desktop computer. After two (2) weeks of administering the post-test, the same test was administered for the measurement of post-posttest (retention) of the students in geometry. The GAT was given as the retention test. The retention test was administered the same manner post-test was administered. The t-test was used to test all the Null hypotheses using Statistical Package for Social Sciences (SPSS) version 16 at 0.05 alpha levels.

Results

Table 1: t-test comparison of Experimental and control group on pre-test Scores

Group	N	df	Mean	SD	t-value	P-value
Experimental Group	40	78	33.95	8.36	0.19	0.17 ^{ns}
Control Group	40		33.55	8.20		

ns: Not significant at the 0.05 level

Table 1 shows the t-test result of the pre-test for the experimental and control group. From the table, the p-value of 0.17 is not significant. This indicates that there is no statistically significant difference between the mean score of the experimental and control group. This therefore, meant that the students in both groups were found to be equivalent with respect to their prior knowledge of the concept of geometry in Mathematics.

HO₁: There is no significant difference in the mean achievement scores of students taught geometry with computer assisted instruction and those taught with lecture teaching method.

Table 1: t-test comparison of experimental and control group on posttest scores

Group	N	df	Mean	SD	t-value	P-value
Experimental Group	40	78	65.63	18.82	2.19	0.03*
Control Group	40		56.93	16.60		

*Significant at the 0.05 level

Table 2 shows the t-test comparison of the posttest mean scores of experimental and control groups. The p-value of 0.03 is significant at 0.05 alpha level. Hence, HO₁ was rejected. The experimental group exposed to CAI performed significantly better than the control group that was taught with lecture method. It could be deduced from the result that the use of CAI had a positive and significant impact on the performance of JSS student in mathematics.

HO₂: There is no significant difference in the mean achievement scores of male and female students taught geometry with computer assisted instruction.

Table 3: t-test comparison of mean achievement scores of male and female students

Group	N	df	Mean	SD	t-value	P-value
Male	20	19	74.00	15.94	6.31	0.001*
Female	20		52.00	17.73		

*: Significant at the 0.05 level

Table 3 shows the t-test comparison of the post-test mean achievement score of male and female student. From the table, the p-value 0.001 is significant at the 0.05 level. This indicates that there is statistically significant difference between the mean score of male and female

students. Therefore, the Null hypothesis was rejected. Male students performed significantly better than their female counterparts.

HO₃: There is no significant difference between the mean retention scores of male and female students taught geometry with computer assisted instruction.

Table 4: t-test comparison of mean retention scores of male and female students

Group	N	df	Mean	SD	t-value	P-value
Male	20	19	64.00	18.75	3.93	0.001*
Female	20		52.50	17.58		

*: Significant at the 0.05 level

Table 4 shows the t-test comparison of the mean retention scores of male and female students. The p-value of 0.001 is less than 0.05 alpha value. Therefore, the research hypothesis was rejected. Hence, there is significant difference between the mean retention score of male and female students taught geometry with computer assisted instruction in favour of male students.

Discussion of Findings

Finding of this study shows that there is significant difference between the achievement of male and female students taught with CAI. The finding is in agreement with the finding of Odok (2006); Vole (2009) and Amelink (2009) who found significant difference between male and female students taught with CAI. However, this findings is in contrast with the earlier findings of Bello (1990); Etukudo (2002) ; Spence (2004) and others who found no significant difference between male and female students achievement when expose to CAI.

The finding is in agreement with the findings of Danmole (1998), Etukudo (2002) and others who found that male students performed better than female students when taught geometry with CAI. Contrary to the finding of Bello (1990); Nussbaum (2000) who observed that there is no significant difference between male and female students in retention when taught with CAI.

Conclusions

The use of CAI package significantly enhances the achievement and retention of students in geometry. This is because computer allows flexible learning approach in the classroom. This ensures practical and meaningful learning. Also, the use of computer assisted instructional package enhance the performance of male students over the female counterparts.

Recommendations

On the basis of the findings from this study, it is recommended that:

- (i) Secondary school Mathematics teachers should be encouraged to explore the application of computer assisted instruction in their classroom instruction in order to ensure effective teaching and learning.
- (ii) There should be the provisions of adequate teaching and learning materials particularly those that have to do with information and communication technology by the government or other relevant stakeholders in order to improve the use of computer devices for meaningful learning of mathematics.

- (iii) Computer programmers and teachers should be encouraged to develop and produce soft ware's which will be used to improve the application of methods of teaching.

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