EFFECT OF COMPUTER-ASSISTED INSTRUCTIONAL PACKAGE ON THE PERFORMANCE OF JUNIOR SECONDARY STUDENTS IN GEOMETRY IN MINNA, NIGER STATE, NIGERIA

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Abstract

This study investigated the effect of computer assisted instruction package on the performance of Junior Secondary Students in Geometry (mathematics) at junior secondary school in Minna, Niger State, Nigeria. It examined the significant of the post-test achievement scores of students taught using: computer and the normal classroom instruction. The sample consisted of forty senior secondary school students drawn from two equivalent secondary schools within Minna metropolis. Stratified random sampling was used to select 40 students (20 males and 20 females). The Mathematics Achievement Test (MAT) was administered to students as pre-test and post-test. The results of students were analyzed using t-test statistics. The results indicated that the students taught using computer performed significantly better than their counterparts taught using the normal classroom instruction. However, there was no significant difference reported in the post-test performance scores of male and female students taught using computer and those taught with normal instruction. These findings indicated that geometry concept in mathematics could be taught and learnt better through the resourceful integration of computer assisted instruction.

Key Words: *Computer-Assisted Instruction; Geometry; students' performance; gender; normal classroom instruction, Mathematics; Senior Secondary School.*

Introduction

Modern civilization stands on a foundation of applied mathematics. Without mathematics, the earth could not support its present population. Mathematics plays important roles in the achievement of scientists and engineers. Knowledge of mathematics has contributed to the tremendous progress in science and technology. It has enabled man to send satellites into the space, to step on other planets, to communicate through information technology, to launch guided missiles and send airships without pilots. Thus, teaching and learning of mathematics occupies an important status in the societal needs (Iqbal, 2004).

Owing to the importance of mathematics, the Federal Ministry of Education in the National Policy on Education (FRN, 2004) made it one of the core subjects to be offered by every student from the primary to the pre-tertiary levels of education. Mathematics helps students to develop a sense of critical observation and to acquire appropriate skills which in turn lead to scientific solution of problems.

Despite the importance of mathematics, the poor performance in mathematics at junior and senior secondary examinations is quite disturbing. The West African Examinations Council (WAEC) Chief Examiner (2005) observed that: the problems affecting mathematics achievement can be related to teachers' method of presenting the content to students; teachers' desirability for new ideas and working effectively within them; and ability to

diagnose individual learning difficulties and styles in mathematics. These drawbacks have led to poor performance in mathematics at secondary schools. The major problem of teaching and learning solid geometry in mathematics at senior secondary schools is poor method of teaching (Ajao, 1986).

Ezeliora (1997) concluded that computer has been used in developed countries to tackle most of teaching and learning problems. It can also be adopted in the Nigerian educational system. Computer can be used to teach all subjects including sciences. Therefore, there is need for using computers in teaching and learning of mathematics in Nigerian schools because of its utility value. Scott (2004) reported that computer assisted instruction can be used to provide opportunities for students to learn by drill and practice, tutorial or simulation activities. Students may use such programs on their own or under the guidance of the teacher. Also, entire lessons may be based on them or they may be used as a supplement to teacher-directed instruction.

There is research evidence that the use of CAI brings about improvement in students' achievement in science courses (Yusuf, 2006; Nwaorgu, 2005 & Adegunna, 2008). Computer assisted instruction can speed up learning rate; enhance better retention; and encourage the development of better attitude (Scott, 2004).

Here in Nigeria, the use of CAL programmes is only just beginning and therefore needs encouragement, especially in the light of their potentiality for raising students' interest, motivation and achievement. Abimbade (1997), Gambari (2004), Dantala (2005), Nwaorgu (2005), Yawa (2006) and Yusuf (2006) revealed that computer-assisted instructional packages produced better learning outcomes in mathematics, physics, history, biology, social studies and primary science respectively. They also found that computer-assisted instruction is gender friendly.

Gender disparity is another major factor of poor performance in mathematics. It has also been found that girls performed poorly relative to boys at all levels of science education (Njoku, 2000). Contrary to this assertion that males students perform better in science than do girls, Anagbogu & Ezeliora, (2007) observed that female students performed better than their male counterparts. Iwendi, (2007) revealed that there is little or no gender differences in performance of males and females in mathematics. Also, Becker (1989) concluded that the magnitude of gender difference in science varies according to the subject matter studied.

Contemporary studies in the developed countries, in the area of educational technology have focused on the use of modern information media (digital interactive video, computer assisted instruction (CAI), satellite, and many others) research efforts in Nigeria are still mainly on established media. In fact, this researcher has not come across any extensive literature on researches on CAI in Nigeria. Furthermore; while some few studies compared CAI and conventional methods researches in other areas of curriculum. The effectiveness of computer for teaching and learning mathematics has not been established in classroom instruction within Nigerian socio-cultural context (Gambari, 2004, Abimbade, 1997, Okebukola, 1990). Thus, this study has provided empirical information on the use of CAI in Nigerian secondary schools.

Research Hypotheses

The following null hypotheses were tested for the study:

(i) There is no significant difference between the students taught mathematics with CAI and those taught without it.

(ii) There is no significant difference between male and female students taught mathematics with CAI and those taught without it.

Methodology

Sample and Sampling Techniques

For the study, a quasi-experimental design of pre-test, post-test, non equivalent, non-randomized control group design was used. Sample subjects consisted of forty (40) class one junior secondary students drawn from two equivalent secondary schools within Minna metropolis. The computer assisted instruction (Experimental Group) consisted' of twenty (20) students and the normal classroom instruction group (Control Group) had twenty (20) students also. The equivalent co-educational schools used for the study were randomly assigned to experimental and control groups using the stratified random sampling technique. Intact classes (one each) were used for the study in sampled schools.

Research Instruments

Treatment Instrument: The researcher prepared four lesson computer assisted instruction package of 40 minutes for experimental Group. The materials were designed to provide visual information covering topics on solid shape geometry (cuboid, cylinder, cube and cone) for junior secondary school class I. The CAI package of four lessons included readiness activities and brief summary of previous lesson. It also contained the instructional content, series of questions related to instructional content and then followed by a summary of the content. For validation, prepared CAI package were given to educational technology and mathematics experts to determine the appropriateness of the materials. Based on their suggestions, further improvements were made. For learners' verification and revision, designed CAI package were used with 20 students drawn from the research population, but they were not used for actual study. After viewing the package, the students responded to evaluation questionnaire.

Test Instrument: The instrument used for the study Mathematics Achievement Test (MAT) on geometric concept in mathematics, constructed by the researcher. It was designed to measure different levels of students' cognitive learning (knowledge, comprehension and evaluation). Initially, it contained a pool of 40 multiple choice questions, having four sections (A, B, C & D). The test was pilot tested once on a sample of 20 students selected from the sample population as the primary sample. Psychometric, proper test of item difficulty was established for the instrument. Through this, 20 questions each containing a stem and four answer choices were retained for final testing. All questions and distractors in section A and the statements in section B were used for the treatment materials (CAI) which also formed the instructional content of the normal classroom instruction group (control). The instrument was validated by ensuring that all question items were derived from the content presented to the two groups, the face validity was also considered. For testing reliability the final draft of the instrument was administered once on another set of 20 students selected from the sample population. A reliability test using the Kudar Richardson Formulae 21 revealed a reliability of 0.82 which was considered good enough for the research study. The achievement test was administered to the groups as pre-test and post-test. To reduce test retest effects, the questions

were administered in a different random order, the pretest and post-test on the scoring of the multiple choice items in section B a score of 5 was awarded for a correct answer and zero for a wrong answer.

An overall instruction for two weeks was conducted in sampled schools, that is, two lessons per week. Each of the groups was given the pre-test before the commencement of instruction. Then, the treatment groups were instructed on how to use computer to learn and solve mathematical problems. Each of the CAI lesson lasted for 40 minutes. The normal classroom instruction was taught using the same content (cuboid and its properties; cube and its properties; cylinder: area and its properties; cone and its properties) in four lessons of 40 minutes each. After the fourth lesson MAT was administered as post-test for each of the groups. The instrument were personally administered by the researcher to the students after the teaching and thus ensured that the instruction on the test instrument was clearly understood. The scripts were also immediately retrieved from the pupils by the researcher after the expiration of the testing period (30 minutes). The scores of the experimental and control groups on the pre-test and post-test were computed and used for data analysis. The scores from the test given to the experimental and control groups were recorded and subjected to data analysis.

Results and Discussion

t-test statistical analysis was used to analyze the data obtained from the pre-test and post-test for the control and experimental groups. The level of the significance adopted for the analysis was $P \leq 0.05$. This level of significance formed the basis for rejecting or not rejecting each of the hypotheses. The summary of the data analysis and results are presented in Table 1:

Table 1: t-test comparison of the pre-test mean scores of Experimental and Control Groups

Variable	N	df	Mean (x)	SD	t-value calculated	t-value critical	P
Experimental group	20	19	24.16	8.04	0.30^{Ns}	2.000	0.05
Control Group	20		23.58	12.32			

Ns – Not significant at $P > 0.05$.

The result in table 1 indicates that there is no significant difference at 0.05 level of significance between the pre-test mean score of the experimental and control groups ($t = 0.30$, $df = 39$, $P > 0.05$). This means that subjects in the experiment and control groups were at the same entry level with regard to academic ability before the mathematics topics were presented to them. Their mean scores were statistically the same

Hypothesis 1:

There is no significant difference in the performance of students who were taught mathematics with computer Assisted instruction and those taught without it.

Table 2: t-test comparison of the post-test mean scores of Experimental and Control Groups

Variable	N	df	Mean (x)	SD	t-value calculated	t-value critical	P
Experimental group	20		85.75	11.12			
					7.55*	2.093	0.05
Control Group	20	19	55.25	14.25			

*: Significant at $P < 0.05$.

Table 3 reveals that there was significant difference between the post-test score of experimental group and control group at 0.05 level of significance ($t = 7.55$, $df = 19$, $P < 0.05$). Therefore hypothesis 2 was rejected. This means that there was a significant difference between the performance of students taught mathematics with computer assisted instruction and those taught without it. Hence computer assisted instruction enhance learning of mathematics.

Hypothesis 2:

There is no significant difference in the performance of male and female students who were taught mathematics with computer assisted instruction package.

Table 3: t-test comparison of the post-test mean scored of male and female mathematics students in the experimental group

Variable	N	df	Mean (x)	SD	t-value calculated	t-value critical	P
Experimental group	10		85.50	10.11			
		9			0.11^{Ns}	2.262	0.05
Control Group	10		86.00	10.20			

Ns – Not significant at $P \leq 0.05$

Table 3 shows that there was no significant difference between the post-test scores of male and female students taught mathematics with computer assisted instruction at 0.05 level of significance ($t=0.11$, $df = 9$, $P > 0.05$). Null hypothesis 2 was therefore not rejected. The performance of male and female mathematics students in the experimental group was enhanced by the use of computer Assisted instruction hence CAI package was gender friendly.

Discussion of Results

From the result in table 2 there was a significant difference in the mathematics achievement of students taught with computer assisted instructions. Those students taught with computer assisted instruction performed better in the mathematics achievement test than those taught with normal classroom instruction. The result from the study is in agreement with earlier findings of Abimbade (1997), Dantala (2005), Gambari (2004), Nwaorgu (2005) and Yawa (2006), Yusuf (2006) that students taught with CAI in Physics, Mathematics, Biology and Social Studies respectively performed better than those taught with conventional teaching method.

The result in table 3 shows that there was no significant difference between the performance of male and female students who were taught mathematics with computer assisted instruction. The male and female equally performed well.

This result is in agreement with Gambari (2004), Dantala, (2006), Nwaorgu (2006), Yusuf (2006) and Yawa (2006) who revealed that computer-assisted instructional package is gender friendly especially when use with physics, history, biology, mathematics and social studies respectively.

Conclusion

The use of CAI produced significant improvement in the post-test achievement scores of students in mathematics. There was a significant difference in the mean scores of students who were taught using computer assisted instruction and those who were taught using the normal classroom instruction. This difference was in favor of students who were taught using CAI. This study has further improved the facilitative effect of CAI in enhancing better achievement in mathematics among male and female students. The implication is that an effective and efficient use of CAI in mathematic instruction will enhance teaching and facilitate the acquisition of knowledge. This is because CAI can be used not only to present learning experiences but also to motivate the students to participate actively in the classroom learning experiences. The study has shown also that geometry concept in mathematics could be better taught and learned through the use of CAI package. Therefore, secondary school teachers should integrate computer into their classroom instruction. Teachers should be resourceful enough to develop computer skills in order to develop computer assisted instruction package suitable for various school programs that can be used to enhance their instructional delivery so that behavioral objectives set for instructions can be achieved.

Recommendations

Based on the result of this study, the following recommendations were made:

(i) Workshops for designing, production and utilization of computer for teachers should be organized by government and non-governmental organizations.

(ii) The use of computer for teaching and learning in the schools should be encouraged by school administrator.

(iii) Federal and state government should provide computers in schools.

References

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

Adegunna, A. D. (2008). *Effect of computer interactive package in solving quadratic equation among senior secondary students in Minna, Niger State.* Unpublished B.Tech. Project, Department Science Education, Federal University of Technology, Minna.

Ajao, S.A. (1986). *A survey of the problems of teaching and learning of Algebra in some selected junior secondary schools in Kwara State*. B.Sc. Ed. Group project A.B.U. Zaria.

Anagbogu, M. A. and Ezeliora, B. (2007). Sex differences and scientific performance. *Women Journal of Science and Technology. 4, 10-20.*

Becker, B. J. (1989). Gender and science achievement. A re-analysis of students from two mental-analysis. *Journal of Research in Science Teaching,* 26(2) 141 – 149.

Dantala, M. (2005). *Effect of computer-aided learning package on the achievement of history in senior secondary school in Minna, Niger State.* Unpublished M.Tech. Thesis, Department of Science Education, Federal University of Technology, Minna. Niger State.

Ezeliora, B. (1997). Computer: *A new technology in chemistry teaching and learning: Innovation in science, technology and mathematics,* STAN Proceeding of Ajumogobia Memorial Conference, pp.257 – 260.

Federal Republic of Nigeria, (2004). *National Policy on Education.* Lagos: Federal Government Press.

Gambari, A.I. (2004). *The Development of Computer-Aided Learning (CAL) Software for individualized instruction of physics in senior secondary schools.* Unpublished M.Tech. Project, Department of Science Education, FUT, Minna.

Iqbal, M. (2004). *Effect of cooperative learning on academic achievement of Secondary school students in mathematics.* Unpublished Ph.D thesis submitted to the university institute of education and research. University of arid agriculture, Rawalpindi, Pakistan.

Iwendi, B. C. (2007). *The influence of gender and age on the mathematics achievement of secondary school students in Minna metropolis, Niger State.* Unpublished M. Tech. thesis, Science Education Dept. FUT, Minna, Nigeria.

Njoku, Z. C. (2000). *Gender and acquisition of science process skills among secondary school students-implication for science and teaching.* 42nd annual conference proceeding of STAN (206 – 209).

Nwaorgu, V. I. (2005). *Relative effectiveness of computer assisted instruction, videotape and realia on the performance of senior secondary students in Biology.* Unpublished M.Tech. Thesis, Federal University of Technology, Minna

Okebukola, P. A. O. (1990). *Computer education in Nigerian schools of the 90's.* STAN Conference Proceedings. Pp38-49.

West African Examination Council, (2001, 2002, 2003, 2004 & 2005). May/June. Chief Examiner's Report. Lagos.

Yusuf, F. I. (2006). *Effects of using computer assisted instruction on the learning of mathematics at senior secondary school level in Minna, Niger State, Nigeria.* Unpublished M.Tech. Thesis, Science Education Department Federal University of Technology, Minna, Nigeria.