

Effect Of Computer Aided Instructions (CAI) On Senior Secondary School Students' Achievement In Mathematics In Makurdi Metropolis Of Benue State, Nigeria

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Abstract: This study targeted the effectiveness of Computer Aided Instructions in the teaching of Mathematics at the senior secondary school level with the sole purpose of reducing the failure rate in specific topics proven to be difficult to pass in Mathematics. The topics considered includes; Sequence/Series and Quadratic Equations. The study adopted an experimental method so as to observe the difference between the CAI teaching method and the traditional teaching method. A sample of 50 students from SS2 were selected from two (2) different schools with similar academic standard with a number of 25 students each representing the two methods. An achievement test (SSQAT) with 40 test items was developed covering the two topics with 20 test items for each topic. The groups were administered a pre-test which showed that there was no significant difference between the groups after which they were taught in a span of four weeks and a post-test was administered at the end. Data analysis was done using mean, standard deviation and t-test. Findings of the study pointed out that the use of CAI in teaching the topics Sequence/Series and Quadratic Equations can produce similar results as the traditional method but better than it because the CAI group performed better even though there was no significant difference in the post test between the experimental and the control groups. There was also no significant difference in the achievement scores between the boys and the girls who were taught with CAI. It can be concluded that this study provides some evidence of the usefulness of CAI in the teaching of Mathematics and holds the potentiality of being a productive and effective media of instruction in teaching mathematical concepts.

Keywords: effect; Computer Aided Instructions (CAI), Achievement, Mathematics, Students, Secondary School.

I. INTRODUCTION

The importance of education cannot be overemphasized in the present day world. Educational research that aims at improving educational standard is a desperate need in the development of a country with science as its base. The rapid advancement in information technology, artificial intelligence, telecommunication among others characterizes the 21st century. The essence of technical skilled manpower

requirement is crucial for the development of our society and hence, the need for education. Mathematics as a subject forms the base for virtually all disciplines and it is a subject made compulsory for all students at the primary and secondary levels. (Ramani & Patadia, 2012). Though a vital subject, mathematics is quite abstract. As a result of the symbols and abstract nature of mathematics, many students find it difficult to understand. Some studies proves that many students avoid the sciences mainly because of Mathematics and hence, the

more population of students in the art and social sciences who do not require core knowledge in mathematics (Olubukola, 2015).

Many reasons have been attributed to students' failure in mathematics. While some study blame the teachers, some other study revealed that lack of interest on the part of the students and lack of commitment of teachers in understanding the basic concepts are some factors responsible. Ramani & Patadia (2012) opined that the present generation has failed in producing adequate number of competent mathematics teachers. Hence, the specialized task of teaching mathematics to educate the young minds with all attention is mostly an illusion.

Achievement in mathematics has also been narrowed to gender differences as many scientists have shown concern as to why more number of boys opt for mathematical inclined courses like engineering and physical sciences compared to the number of girls. Different views from different researchers concerning gender and achievement in mathematics have popped up series of findings. Ajai and Imoko (2015) carried out a research on gender differences in mathematics achievement and retention scores and found out that the male and female students taught Algebra using the problem-based learning (PBL) do not differ significantly in their achievement and retention scores. Imoko and Anyagh (2012) also agreed that girls can compete competently with the boys in mathematics performance but Asante (2010) proved otherwise as his study revealed that boys performed better than girls in mathematics.

Development in the aspect of Computer Technology is becoming more visible in its applications in the field of education. The teaching and learning process can be enhanced with the Computer technology and therefore, teachers as well as students are in dire need of computer literacy to improve the standard expectations of education. According to Timothy (2007), knowing the operations of the computer and its basic fundamental skills constitutes computer knowledge. The Computer Aided Instructions (CAI) is one method through which computers can be used in enhancing the teaching and learning processes. Some researchers have argued that CAI are effective for short-term achievement gains and not for long-term retention while several others have completely opposed the notion. Computer Aided Instruction (CAI), is an interactive technique whereby a computer is used to present the instruction and also to monitor the learning that takes place. It is especially useful in distance learning situation. Computer Assisted Instruction (CAI) system is usually designed to automate certain forms of tutorial learning (Dhevkrishnan & Chinnaiyan, 2013).

The concept of CAI though still emerging has gained fame to some reasonable extent and many researchers have delved into experimental research in the bid to find out its effectiveness in teaching. Some of these researchers include:

Ahiatrogah, Madjoub and Bervell (2013) who compared the effects of CAI on Junior High School students' achievement in Pre-technical skills after exposing them to CAI and the traditional methods of instruction. The study involved 59 students from 2 schools in Kumasi metropolis. Twenty-eight of the students formed the CAI group while 31 formed the traditional group. The study reviewed that the CAI group

performed better than the traditional method of instruction group.

Dhevkrishnan & Chinnaiyan (2012) carried out a study in India to examine the effectiveness of CAI in teaching Mathematics. They developed a CAI on Mensuration and used an experimental group of 30 and 30 as well for the control group who were taught via the traditional method. A pretest was administered to 10 students outside the study sample. Reliability was established by the split half method and the reliability coefficient of 0.81 was established. The test contained 25 test items. Findings showed that the experimental group taught by CAI gained better mean scores in the post test indicating better learning than the traditional group. There was no specification for the duration of the instruction.

Rivet (2001) as cited in Ramani & Patadia (2012) studied students' achievement in middle school Mathematics comparing Computer Assisted Instruction versus the traditional instruction method. Four classes from grade 6 in two different middle schools were used. 2 classrooms used the CAI in mathematical concepts that relates to fractions and on the same topic, the other 2 classes were taught using the lecture method and textbook. A quasi experimental pre-test and post-test design was used and the CAI classrooms performed better than the traditional classrooms at each school.

Similarly, researches on CAI have also been carried out on other subjects as well; Okoro and Etukudo (2001) confirmed the benefit of CAI for teaching chemistry, Paul and Babaworo (2006) applied it in technical education courses, Egunjobi (2002) in geography and Karper, Robinson, and Casado – Kehoe (2005) on counseling education. Conflicting evidence have been presented in some other studies where students who used CAI either had no significant difference in the post test scores or even scored lower than students who received the traditional lessons (Linden, 2008; Santally, Boojawon, & Senteni, 2004; Daramola & Asuquo, 2006).

To determine the effectiveness of CAI is crucial. Ramani and Patadia (2012) opined that there are many failures in Mathematics than any other subject, hence the need for a supplement along the classroom teaching.

Considering the issue of gender difference, some researchers are of the view that gender gaps in mathematics achievement can be attributed to some factors such as cultural, socio-economic or parental influence (Kaino, 2001; Kaino, 2004). Other factors also considered includes students' interest, self-esteem, curricular materials, students' attitude etc. (Ajai & Imoko, 2015).

Ursini, Ramirez and Sanchez (2006) with the aim to determine significant differences in students within the ages of 12 and 13 years between boys and girls, and by gender (masculine, feminine, androgynous and undifferentiated traits); carried out a research where 1056 students were given a mathematical test and the BEM sex inventory. The result showed that no significant differences was found considering sex, however students with masculine traits did better in terms of achievement. The results from the study going by gender cannot be reliable because over time gender traits can change especially as girls' gets older and maturity sets in. 1056 students participated in the study with 50.7% females and

49.3% males. A 14 multi choice items questionnaire was used to test students' mathematical knowledge.

One way to bridge gender gap in mathematics is to give them equal opportunity of learning via an interesting medium like the computer and it is in this view that this study imbibes the Computer Aided Instruction in the teaching of Mathematics in the bid to improve students' performance generally as well as handle the issue of gender difference in the achievement and retention of Mathematical concepts by students in the senior secondary schools in Makurdi metropolis, Benue State of Nigeria.

II. STATEMENT OF THE PROBLEM

It has been observed that certain topics in mathematics are difficult to pass; which in turn affects students' achievement especially at the senior secondary level and the traditional method of teaching mathematics is prevalent among secondary schools in Benue State, Nigeria. This study therefore aims to find out the effectiveness of CAI in the teaching/learning of Mathematics in senior secondary schools and to find out if CAI will have any influence on gender differences in terms of students' achievement in mathematics.

RESEARCH QUESTIONS

- ✓ What are the mean achievement scores in Sequence/Series and Quadratic Equation Achievement Test (SSQAT) of students taught mathematics in the experimental and control groups?
- ✓ What are the mean achievement scores in Sequence/Series and Quadratic Equation Achievement Test (SSQAT) SSQAT of male and female students in the experimental group?

RESEARCH HYPOTHESES

- ✓ There is no significant difference between the mean achievement scores of students in the experimental and control groups.
- ✓ There is no significant difference in the mean achievement scores between the male and female students in the experimental group.

SCOPE OF THE STUDY

The scope of this study is delimited to the preparation of CAI package on Mathematics for Senior Secondary School 2 students. Sequence and Series as well as Quadratic Equations were considered.

One way to bridge gender gap in mathematics is to give them equal opportunity of learning via an interesting medium like the computer and it is in this view that this study imbibes the Computer Aided Instruction in the teaching of Mathematics in the bid to improve students' performance generally as well as handle the issue of gender difference in the achievement of students in Mathematical concepts in Makurdi metropolis, Benue State of Nigeria.

III. METHODOLOGY

A quasi-experimental approach was adopted for the study. The CAI for Sequence and Series and for Quadratic Equations was developed and the design of the CAI was quite flexible for students to be able to lay hands on and learn even after the class. On the other hand, a control group was selected for which lesson plans were developed to be taught in the traditional way. The study was carried out in Makurdi Local Government Area of Benue State.

The population of the study comprised of 5225 students from both private and government secondary schools in Makurdi Metropolis. The choice of SS2 students was based on the fact that the students must have been exposed to series of mathematical concepts and are expected to be getting ready to sit for WASSE and NECO. The eagerness to learn is there and more so, they are expected to have certain level of knowledge to be able to attempt the SSQAT. One of the schools served as the experimental group which was taught with CAI while the other school was used for the control where the regular chalkboard teaching method was used.

The instrument used for the study was the Sequence/Series and Quadratic Equation Achievement Test (SSQAT) that had a 40 multiple choice objective items with four options. This instrument was validated by experts in Mathematics education and corrections were effected in the weaknesses identified. Pre-test was formally administered to the students prior before the study commenced and there was no significant difference between the mean scores of the two groups. To ensure content validity of the test items, the tests were given to mathematics experts to review the content. The reliability coefficient was computed using split half estimates spearman-brown prophesy formula and a value of 0.72 was obtained. The instrument SSQAT was administered to the two groups at the various schools. To obtain a pre-test data, students were given the pre-test assessment that lasted for a day. After which different methods of teaching were adopted for the schools. The experimental used CAI while the control used the lesson plan in the conventional way. Participants were exposed to 40 minutes of teaching the topics twice a week for four weeks. After four weeks of treatment, the SSQAT was administered to the groups and scores obtained provided the post test data.

Research Questions were answered using means and standard deviations while the testing of the formulated hypotheses made use of the two tailed t-test at 0.05 level of significance.

IV. RESULTS AND DISCUSSION

RESEARCH QUESTION 1

What are the mean achievement scores in SSQAT of students taught mathematics in the experimental and control groups?

Group	N	Mean	S.D	t-value	Level of Significance
Control	25	24.36	4.66	0.54	Not significant
Experimental	25	20.76	4.00		

Table 1: Experimental and Control Groups in the Post-test

Table 1 above shows that the mean scores of the experimental and control groups are 24.36 and 20.76 respectively in the post-test with a mean difference of 3.60 in favor of students taught in the experimental group. This implies that the use of CAI as a teaching method for the topics Sequence and Series as well as Quadratic Equations had some good effect on the students' achievement in Mathematics when compared with the traditional teaching method. The standard deviations are 4.66 and 4.00 for the experimental and control groups respectively.

HYPOTHESIS 1

There is a significant difference between the mean achievement scores of students in the experimental and control groups.

Testing how significant this difference meant could not be achieved with the result of the t-value from same table 1, the calculated t – value (0.537) is less than the critical t- value (2.0106) at 0.05 level of significance. The condition for significant difference between the two groups for a two tailed t test envisages that the calculated t-value must be greater than the critical value of t under degree of freedom (df) 48 which is 2.0106; because the t-value contradicts the condition for significance, the null hypothesis of a significant difference in the scores between the control and experimental group is thereby rejected while the alternative hypothesis of no significant difference between the mean scores obtained by the control group is hereby accepted. Although the mean difference of 3.60 in favor of the experimental portrays a better effect of the CAI teaching method but the impact of the difference in the mean scores not been significant in the inferential test has put limitations on the justification of hypothesis 1

RESEARCH QUESTION 2

What are the mean achievement scores in SSQAT of male and female students in the experimental group?

Group	N	Mean	S.D	t-value	Level of Significance
Girls	11	20.18	2.21	1.57	Not Significant
Boys	14	20.64	4.57		

Table 2: Achievement Scores of Boys/Girls in the Experimental Group

Table 2 above shows the mean achievement scores of the male and female students in the SSQAT. Out of the 25 students that participated in the experimental group, 44% were girls and 54% boys. The girls had 20.18 as the mean score while the boys had 20.64. This implies that a mean difference of 0.56 which is quite slim exists between them. This shows that not much difference was observed between the boys and girls performance in the SSQAT post-test. The standard

deviations for the male and female are 2.208 and 4.576 respectively.

HYPOTHESES 2

There is no significant difference in the mean achievement scores between the male and female students

Table 2 above shows the mean achievement scores of the male and female students in the SSQAT. Out of the 25 students that participated in the experimental group, 11 were girls and 14 boys. The girls had 20.18 as the mean score while the boys had 20.64. This implies that a mean difference of 0.56 which is quite slim exists between them. This shows that not much difference was observed between the boys and girls performance in the SSQAT post-test. The standard deviations for the male and female are 2.208 and 4.576 respectively.

A mean difference from table 2 that a difference of 0.56 existed in favor of the boys. The t-value from table 2 (1.57) is less than the critical t-value (2.069) at 0.05 level of significance. The condition for significant difference between the 2 groups for a two tailed t test envisages that the calculated t-value must be greater than the critical value of t under degree of freedom (df) 48 which is 2.069. The t-value 1.57 shows that there is no significant difference in the mean achievement scores of the male and female students in the experimental group.

V. DISCUSSION OF FINDINGS

The findings from table 1 indicated a difference of 3.60 in the mean scores obtained by the control group and the experimental group in the post-test in favor of the experimental. Though, this difference when tested statistically using the two tailed t-test proved to be insignificant. Hence the null hypothesis H_0 stating "there is a significant difference between the post-test scores of the control and experimental groups" was rejected. From a similar research conducted by Daramola and Asuquo (2006) on the effect of CAI on secondary school students in Nigeria, it was concluded that there was no significant difference in the performance of students exposed to individualized CAI and those taught using the conventional instructional method contrary to findings from Rivet (2001) and Dhevakrishnan and Chinnaiyan (2013). This finding goes on to say that the CAI method of Instruction have the ability to produce similar results in achievement as the traditional method in some topics in Mathematics. Moreover, the mean difference of 3.60 in favor of the experimental indicates that if properly harnessed, the CAI have great tendency in improving students' achievement in Mathematics. It is safe to say from this finding that CAI can actually provide students with an alternative to classroom settings if all the needed resources are put in place.

The results from table 2 indicates that there is no significant difference in the scores of the post-test between the boys and the girls in the experimental group even though a mean difference of 0.56 existed in favor of the boys. It is safe to conclude that the teaching of Mathematics with CAI does not favor a specific gender in terms of achievement; as the

girls can compete adequately with the boys with no much difference.

VI. CONCLUSION

The following findings were made:

- ✓ The difference in the mean scores obtained by the control group and experimental group was not significant. Even though the mean difference of 3.60 existed in favor of the experimental, statistically, a significant difference could not be attained at 0.05 level of significance.
- ✓ The mean difference of 0.56 existed in favor of the boys in the mean achievement scores of males/females in the experimental group. The t-value (1.57) is not significant at 0.05 level of significance and so the hypothesis that says there is no significant difference in the mean achievement scores between the boys and girls holds.

VII. RECOMMENDATIONS

Consequent upon the results from the study, the following points are recommended:

- ✓ Computer Aided Instructions should be incorporated into Mathematics curriculum for senior secondary schools especially for complex topics which students find difficult to pass. Development of CAI for such topics should be such that students can learn at their pace with drills and practice. The implication of this is that the students will require a computer system with the CAI software installed on it. So that outside the classroom teaching, students can practice and learn during their leisure time.
- ✓ Government needs to improve on power supply for the feasibility of the CAI teaching method to be carried out in schools. Else, the high cost of fuelling generators to power the computer systems would be discouraging and even schools that have computer laboratories will end up locking them up.

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