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CALL FOR PAPERS
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MODERATING EFFECTS OF GENDER AND MATHEMATICAL ABILITY ON COMPUTER ASSISTED INSTRUCTIONAL STRATEGY AND STUDENTS' ACHIEVEMENT IN MATHEMATICS

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Abstract

The study determined the moderating effects of gender and mathematical ability on computer assisted instructional strategy (drill-and-practice and tutorial) and students' achievement in quadratic equation. The pretest-posttest control group quasi-experimental design was used. The study was conducted in Senior Secondary Schools in Ibadan North Local Government Area, Oyo State, Nigeria. Two hundred and sixty Senior Secondary School two students participated in the study. They were randomly assigned to groups. Treatment lasted four weeks. Instruments used were Quadratic Equation Achievement Test ($r=0.87$) and Mathematical Ability Test ($r=0.73$) and teachers' instructional guide. Data were analysed using Analysis of covariance and Bonferroni post-hoc test at $p \leq 0.05$. Mathematical ability has significant effect on students' achievement in quadratic equation, but gender did not. Also, there were significant main effects of mathematical ability ($F_{(2,241)}=7.967$; partial $\eta^2=0.062$) and gender ($F_{(1,241)}=28.063$; partial $\eta^2=0.104$), respectively on students' achievement in quadratic equation. Other interaction effects (treatment and gender, mathematical ability and gender, treatment, mathematical ability and gender) were not significant. Drill-and-practice and tutorial Strategies enhanced student achievement in quadratic equation.

Keywords: Achievement; Drill-and-practice, Tutorial, Gender, Mathematical ability

Introduction

Mathematics is widely used throughout the world, in human life and many fields including Social Sciences, Natural Sciences, Engineering, Medicine and Education. It is a vital tool in science, commerce and technology. According to Maass, Geiger, Ariza and Goos (2019), mathematics provides an important key to understanding of the world. The Nigerian Federal Government made mathematics compulsory and one of the core subjects in both primary and secondary schools because of its usefulness (Federal Republic of Nigeria, 2013). Some of the roles of mathematics according to Jega and Julius (2018), include: its ability to enhance the thinking capabilities of individuals by making them to be more creative, reasonable,

and rational as well as imaginative. There is no school curriculum or a national development planning which does not take cognizance of the usefulness and development in school mathematics. Mathematics is a body of knowledge centred on concepts such as quantity, structure, space, change and also the academic discipline that studies them (Li and Schoenfeld., 2019).

The National Curriculum for senior secondary schools (Nigerian Educational Research and Development Council [NERDC, 2014]) on mathematics is divided into six sections, which include: Number and Numeration; Algebraic processes; mensuration; plane geometry; Trigonometry, statistics and probability. The focus of this study is on algebraic processes. This is because reports have shown that algebra occupies a major content in school mathematics and students perform poorly in algebra (WAEC Chief Examiner Report, 2018). Algebra is a branch of mathematics of Arabian origin. It is a generalization and extension of arithmetic in which symbols are employed to denote operations and letters to represent number and quantity. Algebra involves solving equations, graphing linear, simultaneous linear and mathematics (Federal Ministry of Education, 2016). These areas have the potential to open students' mind towards different styles of thinking and understanding. It is good for students to know the basic fundamentals in Algebra so as to meet up with the challenges of other areas of mathematics.

The forms of algebraic equations are as follows: Linear equations, Simple and Simultaneous equations, Mathematics, Cubic Equations and Exponential Equations. Algebra is a major topic in senior secondary two mathematics curriculum and also appears in West African School Certificate Examination (WASCE) and National Examination Council of Nigeria (NECO) Certificate Examinations. According to WAEC Chief Examiner's report (2018), algebra is among the area students avoid attempting questions on while those who dare to, perform poorly. The WAEC Chief Examiner's report (2018) further indicated that most candidates ended up completing the table of values but were not able to plot the correct graph or to read off the roots of the equations. According to Jack and Thompson (2017), Algebra is an aspect of mathematics which every individual must know, as it is a gateway to other areas of mathematics, yet many students struggle with Algebra and are left behind because they find it difficult to understand. It is the importance of Algebra that makes it to appear in almost all the classes in the National Mathematics Curriculum. Some students do not like solving algebraic problems as they find algebra difficult and abstract. According to Malik (2018), the problem of failure at this level has always been attributed to teacher's failure to use appropriate method of teaching and teachers lack of knowledge of technological innovations in the society. Hence a better teaching pedagogy of the concept was suggested.

Acharya (2017) was of the opinion that poor method of teaching and lack of basic knowledge are responsible for the observed poor performance of students in secondary school mathematics. Kapur (2018) also noted that poor textbooks and lack of computer technology in schools are also responsible for poor performance of students in mathematics. Jega and Giro (2017) are of the opinion that lack of

algebraic knowledge and unavailability of computers are responsible for poor performance of students in mathematics. They suggested that teachers should be sent for in-service training and re-training so as to meet up with the technological challenges in the society and also improve students' learning outcomes in mathematics. Luttenberger, Wimmer and Paechter (2018) and Namkung, Peng and Lin (2019) reported that poor students' performance in quadratic equation has been more prominent in some aspects of mathematics curriculum content than in others. Such content areas have also been shown to be very difficult to tackle by students. Some topics identified by Wonu and Zalmon (2017) in the senior secondary school mathematics and further mathematics to be difficult to comprehend by students include geometry, number and numeration, algebraic processes, statistics and probability; and calculus.

The attempt to take care of poor performance of students in mathematics inspired some researchers to use computer technology in the classroom. Such researchers include Hu and Li (2017) Jega and Giro (2017), Kapur (2018), Panthi and Belbase (2017). Jega and Giro (2017) observed that learners are happier when they engage in mathematics with a sense of personal accessibility, coalescence and application rather than just a body of knowledge and skill. Shin and Bryant (2017) in their own view noted that the computer in teaching creates room for self-checking and that the visual pictures enhance visualization and sensory perception. Computers have the property of being patient and does not care how often the user makes mistakes.

Computers have been found to be generally cost effective in teaching and learning, especially in science, mathematics and technology-related subjects (Ball, Huang, Rikard and Cotten 2019). By its very precise and symbolic nature, mathematics lends itself as a tool or language of communication, especially as it is regarded as the core of all sciences. It is not surprising, then that mathematics has always been at the forefront of researches and experiments. With the inception of the school-Net project in Nigerian public schools, the introduction of the Computer Assisted Instruction (CAI) is sure to project mathematics to the limelight more than ever before. Programmes to teach basic computational skills in elementary arithmetic are the most developed areas and the material is programmed in the drills and practice mode. From all the research findings on the use of computers in teaching and learning mathematics, it appears that computer use has tremendous advantages in other nations like America, Britain, Japan, etc. (Voskoglou 2020).

Computer technology can be used to assist instruction, manage instruction and aid design. However, when computer is used to assist instruction, it is referred to as 'Computer Assisted Instruction'. Computer can be used in teaching quadratic equation as a tutor and as drill-and-practice. As a tutor, the computer acts as tutor by performing a teacher's role. The student is tutored by the computer to increase their skills and knowledge. Applying computer as drill-and-practice can help develop higher order thinking, creativity and research skills thereby enhancing learning. Computer Algebra Application Software (CAAS) is one of the software that applies

computer as Drill-and-practice and can demonstrate how computer could be used as drill-and-practice for solving mathematical problems because of its computational powers. CAAS can manipulate symbolic expressions or equations, find exact values for functions or equations and graph functions and also plot relations.

The tutorial package which is Intelligent Tutoring Application Software (ITAS) demands self-contained and guided instructional programs. The program requires little or no assistance from the teacher(s) of mathematics (Treceño-Fernández, et al., 2020). The computer monitor or screen has to be operational in order to enable a proper display of the concepts to be learnt. The students should be properly taught on the use of the major function keys of the computer keyboard. The tutorial method is a type of programmed learning, using Stimulus-Response theory of learning.

Statement of the Problem

The incessant poor performance of students in both internal and external examinations vindicate that students find it hard to understand mathematics. Difficulty in learning mathematics has been associated with poor teaching methods teachers used in teaching the subject which failed to arouse the interests of the students in learning the subject. Research evidence shows that the use of Computer Assisted Instruction could bring about improvement in students' achievement, speeds up learning rate, enhances better retention, and improve students' achievement in the subject. However, to what extent would the use of Drill-Practice or Tutorial approaches in Computer Assisted Instruction be effective in improving students' achievement in algebra.

Hypotheses

The study was guided by the following formulated null hypotheses. The hypotheses were tested at 0.05 significant level.

- H₀1: There is no significant main effect of treatment on students' achievement in quadratic equation
- H₀2: There is no significant main effect of mathematical ability on students' achievement in quadratic equation
- H₀3: There is no significant main effect of gender on students' achievement in quadratic equation
- H₀4: There is no significant interaction effect of treatment and mathematical ability on students' achievement in quadratic equation
- H₀5: There is no significant interaction effect of treatment and gender on students' achievement in quadratic equation
- H₀6: There is no significant interaction effect of mathematical ability and gender on students' achievement in quadratic equation
- H₀7: There is no significant interaction effect of treatment, mathematical ability and gender on students' achievement in quadratic equation

Significance of the study

This study focuses on comparing two modes of using computer in teaching

and learning of quadratic equation: computer as drill and practice, and as tutorial. It is hope that this study will enable the mathematics teachers identify the mode of using computer in teaching students for effective teaching and learning. Apart from adding to the number of instructional strategies at their disposal, it might make the teaching of quadratic equation more enjoyable and hence improve achievement. It will also be useful to programmers and software designers to understand the appropriate way to program for effective teaching and learning.

Scope of the Study

This study is delimited to comparing the effectiveness of using computer and not using computer in teaching and learning of quadratic equation. Only Senior Secondary Two (SS11) students were used for the study. This is because students in this class are not beginners in Algebra and will be able to understand quadratic equation concepts when software is used. The contents to be covered are the four methods of solving quadratic equation problems which include factorization, completing the square, formulae and graphing.

Methodology

Research Design

The study adopted the pretest-posttest control group quasi-experimental design. This is because there was manipulation of the independent variables. The population for the study were the Senior Secondary Two (SS II) students in Ibadan North Local Government Area. Six Senior Secondary Schools in the Local Government Area were purposively selected. The schools with computer and electricity facility were selected for this study. The researcher selected one class from each school making a total of six intact classes. Only (SS II) students were selected. The students were taught the same concept of quadratic equation using drill-and-practice, tutorial Strategy and the conventional Strategy.

The instrument used for data collection was the Quadratic Equation Achievement Test (QEAT). Objective items designed to measure the cognitive aspect related to the concept of the study. There were 30 multiple choice items revolving around quadratic equation. Out of the 30 questions, 12 measured knowledge, eight measured comprehension, while 10 measured application base on the table of specification. One test was used for pretest and posttest. For posttest, adjustment was made in the numbering and the options were equally interchange. This will reduce the effect of pretest on the posttest. A stem is followed by five (5) options lettered (A-E) out of which only “one” was correct. Students were instructed to select only one option as answer for each item. All the options were plausible answers to the item. There was a trial testing (Pilot testing) of the Quadratic Equation Achievement Test (QEAT) to estimate the internal consistency and stability of the instrument. The researcher administered the instruments to SS II students in two schools in Ibadan North Local Government Area which is outside the schools selected for the study. The face and content validity of the instrument were determined by two mathematics teachers who were actively involved in teaching SS II students from two different schools other than those to be used for the study to

ensure that the items were suitable for SS II students. The reliability index of 0.87 was obtained using Kuder Richardson formula (K-R 20).

In conducting the study, classes in each samples school, were randomly assigned to treatment and control groups. The data for testing the hypotheses were collected from the pretest, posttest and questionnaire administered to the subjects used in the study. Each of the tests were marked and scored over hundred percent. One group was exposed to Quadratic equation lesson using Drill-and-Practice Strategy for the period of Four weeks, another group was also taught the same Quadratic equation lesson using the Tutorial Strategy, while the other group was taught the same Quadratic equation lesson using the Conventional Strategy. The total number of lessons within four weeks was twelve periods which lasted for forty minutes each. After the duration of four weeks of treatment for the Drill-and-Practice Strategy, four weeks for the Tutorial Strategy and four weeks for the Conventional Strategy, posttest was administered to the groups at the same duration in the usual paper and pencil method. The scores obtained from the intact classes were computed while research hypotheses were tested at 0.05 significance level using Analysis of covariance (ANCOVA) in testing hypotheses. In this case, ANCOVA was used to determine whether there is significant difference between the means of the groups.

Results

Hypotheses One

H₀₁: There is no significant main effect of treatment on students' achievement in quadratic equation

Table 1: Analysis of Covariance (ANCOVA) of Post-Achievement by Treatment, Mathematical Ability and Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1623.222a	18	90.179	12.673	.000	.486
Intercept	1533.349	1	1533.349	215.477	.000	.472
Pre-Achievement	136.679	1	136.679	19.207	.000	.074
Treatment	15.555	2	7.777	1.093	.337	.009
Mathematical ability	113.394	2	56.697	7.967	.000*	.062
Gender	199.702	1	199.702	28.063	.000*	.104
Treatment x Mathematical ability	110.613	4	27.653	3.886	.004*	.061
Treatment x Gender	16.457	2	8.228	1.156	.316	.010
Mathematical ability x Gender	4.832	2	2.416	.339	.712	.003
Treatment x Mathematical ability x Gender	56.808	4	14.202	1.996	.096	.032
Error	1714.975	241	7.116			
Total	163199.000	259				
Corrected Total	3338.196					

R Squared = .486 (Adjusted R Squared = .448) * denotes significant at p<0.05

The result showed that there is no significant main effect of treatment on students' achievement in Quadratic equation ($F_{(2,241)} = 1.093$; $p > 0.05$, partial $\eta^2 = 0.009$). Thus, hypothesis 1a was not rejected. In order to determine the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups was carried out and the result is presented in the table

Table 2: Estimated Marginal Means for Post-Achievement by Treatment and Control group

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Lower Bound
Drill-and-Practice Strategy (DPS)	25.00	.313	24.383	25.616
Tutorial Strategy (TS)	24.94	.329	24.294	25.589
Conventional Strategy (CS)	24.37	.348	23.680	25.049

The result revealed that students in Drill-and-Practice Strategy (DPS) treatment Group 1 had the highest adjusted post-achievement mean score in Quadratic equation (25.00) followed by Tutorial Strategy (TS) Group 2 (24.94), while the Conventional Strategy (CS) treatment Control Group had the least adjusted post-achievement mean scores in Quadratic equation (24.37) but this difference in their mean scores is not statistically significant.

H₀2: There is no significant main effect of mathematical ability on students' achievement in Quadratic equation

The result revealed that there is a significant main effect of mathematical ability on students' achievement in Quadratic equation ($F_{(2,241)} = 7.967$; $p > 0.05$, partial $\eta^2 = 0.062$). The effect is 6.2%. This indicates that 6.2% variation in students' achievement in Quadratic equation is accounted for by the treatment. Thus, hypothesis 2a was rejected. In order to determine the magnitude of the significant main effect across mathematical ability groups, the estimated marginal means of the treatment groups was carried out and the result is presented in Table 3

Table 3: Estimated Marginal Means for Post-Achievement by Mathematical Ability

Mathematical ability	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Lower Bound
Low	23.29	.492	22.318	24.256
Medium	24.90	.292	24.320	25.469
High	26.12	.366	25.402	26.845

Table 3 revealed that high mathematical ability students had the highest adjusted post-achievement mean score in Quadratic equation (26.12) followed by medium mathematical ability students (24.90), while their low counterparts had the least

adjusted post-achievement mean scores in Quadratic equation (23.29). This order can be represented as High > Medium > Low.

Table 4 Bonferroni Post-hoc Analysis of Post-Achievement by Mathematical Ability

Mathematical ability	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Lower Bound
Low	23.29			*
Medium	24.90	*		
High	26.12			

Result in Table 4 revealed that medium mathematical ability students were significantly different from their low counterparts but did not differ significantly from their high mathematical ability students in their post-attitudinal scores in Quadratic equation. Furthermore, high mathematical ability students were not significantly different from their low ability counterparts. This implies that the significant difference reveals by the ANCOVA is a result of the difference between the medium mathematical ability students as far as post-attitude is concerned.

H₀₃: There is no significant main effect of gender on students' achievement in Quadratic equation

The result showed that there is a significant main effect of gender on students' achievement in Quadratic equation ($F_{(1,241)} = 28.063$; $p < 0.05$, partial $\eta^2 = 0.104$). The effect is 10.4%. This indicates that 10.4% variation in students' achievement in Quadratic equation is accounted for by gender. Thus, hypothesis 3a was rejected. In order to determine the magnitude of the significant main effect across gender, the estimated marginal means of the treatment groups was carried out and the result is presented in Table 5

Table 5: Estimated Marginal Means for Post-Achievement by Gender

Mathematical ability	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Lower Bound
Male	25.77	.287	25.203	26.334
Female	23.77	.251	23.275	24.262

Table 5 reveals that male students had the higher adjusted post-achievement mean score in Quadratic equation (25.77) while their female counterparts had the least adjusted post-achievement mean scores in Quadratic equation (23.77).

H₀₄: There is no significant interaction effect of treatment and mathematical ability on students' achievement in quadratic equation

The result showed that there is a significant two-way interaction effect of treatment and mathematical ability on students' achievement in quadratic equation ($F_{(2,241)} = 3.886$, $p < .05$, partial $\eta^2 = 0.061$). The effect size is 6.1%. Thus, the null hypothesis 4 was rejected. This implies that treatment and mathematical ability had effect on students' achievement in quadratic equation. In order to explore the interaction effect, Figure 1 presents the interaction in line graph.

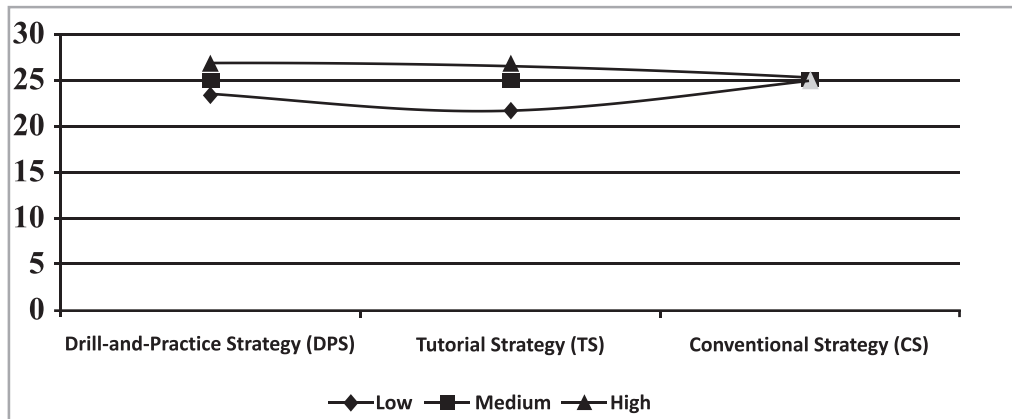


Fig.1: Treatment and Mathematical Ability on Students' Achievement in Quadratic Equation

The result showed that high mathematical ability students in drill-and-practice strategy had better achievement mean score (26.78) in quadratic equation, and is followed by their high mathematical ability counterparts in tutorial strategy (26.55), high mathematical ability students in conventional strategy (25.04), medium mathematical ability students in tutorial strategy (24.96), low mathematical ability students in conventional strategy (24.93), medium mathematical ability in drill-and-practice strategy (24.87), medium mathematical ability students in conventional strategy (24.86), low mathematical ability students in drill-and-practice strategy (23.35), while low mathematical ability students in the tutorial strategy had the least achievement mean score in quadratic equation (21.58). The interaction is disordinal. This implies that based on the mathematical ability, it is not the same group of students across the strategy that had better achievement mean scores.

H₀₅: There is no significant interaction effect of treatment and gender on students' achievement in quadratic equation

The result from Table 1 showed that there is no significant two-way interaction effect of treatment and gender on students' achievement in quadratic equation ($F_{(2,241)} = 1.156$, $p > .05$, partial $\eta^2 = 0.010$). Thus, the null hypothesis 5 was not rejected. This implies that treatment and gender have no effect on students' achievement in quadratic equation.

H₀6: There is no significant interaction effect of mathematical ability and gender on students' achievement in quadratic equation

The result from Table 1 showed that there is no significant two-way interaction effect of mathematical ability and gender on students' achievement in Quadratic equation ($F_{(2,241)} = 0.339$, $p > .05$, partial $\eta^2 = 0.003$). Thus, the null hypothesis 6 was rejected. This implies that mathematical ability and gender have no effect on students' achievement in quadratic equation.

H₀7: There is no significant interaction effect of treatment, mathematical ability and gender on students' achievement in quadratic equation

The result from Table 1 showed that there is no significant three-way interaction effect of treatment, mathematical ability and gender on students' achievement in quadratic equation ($F_{(4,241)} = 1.996$, $p > .05$, partial $\eta^2 = 0.096$). Thus, the null hypothesis 7 was not rejected. This implies that treatment, mathematical ability and gender have no effect on students' achievement in quadratic equation.

Discussion of Findings

Treatment and Students' Achievement in quadratic equation

Based on the findings of the study, it is obvious that the experimental group I taught with Drill-and-Practice performed better than their counterparts in the experimental group II taught with Tutorial method and control group taught with Conventional method. It was also observed that students from the experimental group I understood questions faster, responds sharper and retained their learnt concepts longer, but in the experimental group II where the computer machine served as a tutorial aid, many of the students became simple observers of the computer mystery. Ozofor (2015) reported that the more children (students) interacted with the computer, the faster they think, answer questions more logically and retained the contents learnt longer. However, Erbas, Ince and Kaya (2015) remarked that all the approaches of the computer aided instruction do not yield the same result when they are used in teaching quadratic equation. Furthermore, this study revealed that experimental group I taught using Drill-practice approach showed more interest in the use of the computer in learning quadratic equation. More so, some of the students in experimental group II taught with tutorial approach were stimulated by the way the machine was teaching. These two are consistent with earlier postulate of Liou (2012) who reported that students of languages in universities found Computer Assisted Language Learning very interesting and stimulating.

Similarly, Ahmadi and Reza (2018) reported that teacher's use of computers motivated students to learn. Contradicting these reports, Shieh and Yu (2016) in his study observed that teachers and students' attitude towards computers in education believed that computers in schools do not encourage creativity, invention and discovery. In support of Collins, Brown, and Newman (2018), Ozofor (2015)

reported that the ignorance of the teachers in the computer modes got many of the students more confused learning quadratic equation especially those in the experimental group II.

The results showed that students in experimental group I (drill-and-practice) had a higher mean achievement score in quadratic equation than students in experimental group II (tutor). This indicated that mode of computer usage is a significant factor in the mean achievement scores of students in quadratic equation. This means that students who were taught with computer as drill-and-practice achieved higher than those who were taught with computer as tutor. The reason for the better achievement by the experimental group I was because, no matter the gadget or instrument that one discusses with, it cannot be compared with human being whom you can ask questions, watch his countenance and feel his presence. This is in agreement with Popenici and Kerr (2017), who stated that the computer cannot replace the teacher. Actually, the teacher's place cannot be replaced rather teachers should use the various technologies, innovations and strategies to augment their teachings and as teaching aids. Thus, this result adopts the use of computer as drill-and-practice for meaningful learning/teaching of quadratic equation. This result was supported by Raja and Nagasubramani (2018) who indicated that it is good to use computer in teaching as it will take care of poor method of teaching and poor textbooks prevalent in schools. Again, it can be observed from the result that the mean achievement scores for both the experimental groups 1, 11 and control are generally low. This showed a general poor performance of students in Mathematics which supported the WAEC Chief Examiners Report (2018) that students perform poorly in Mathematics and suggested that teachers should intensify effort in bringing out strategies that will improve students' performance for a meaningful teaching and learning of Quadratic equation.

Gender and Students' Achievement in quadratic equation

The results indicated that male students performed better than their female counterpart. More so male students that were taught with computer performed better than male students that were taught without computer. Like-wise female students that were taught with computer performed better than female students that were taught without computer. However, testing for significance, the results indicated that the difference in the mean achievement of male and female students was not statistically significant. This result was supported by Awortwe, Nyatsikor and Sarfo (2019), who indicated that the computer dehumanizes and does not care whether you are a male or a female. The use of computer in teaching quadratic equation is therefore a good strategy of bridging the gap that ever existed between male and female students' achievement in quadratic equation as reported by Awortwe, Nyatsikor and Sarfo (2019), Agbo-Egwu, Egbunu and Anyagh, Ojaleye and Awofala (2018), Barraza Castillo, Cruz Sánchez and Vergara Villegas (2015). Results revealed that there is no significant interaction effect between modes and gender on students' achievement. This result is in concordance with Emeka, Amusa and

Edogbanya and Abonyi, Maduagwuna and Ugama (2014) whose results indicated that there was no significant difference between male and female students' achievement in Quadratic equation. Equally, this result agrees with Ajai and Imoko (2015) who revealed that male students perform better than female students in Quadratic equation though the difference is not statistically significant. Ajai and Imoko attributed the difference to attitudinal, psychological and socio-cultural factors on girls.

Mathematical Ability and Students' Achievement in quadratic equation

The results revealed that high mathematical ability students had the highest achievement mean score in Quadratic equation followed by medium mathematical ability students, while low mathematical ability students had the least achievement mean score. Furthermore, it revealed that high mathematical ability students were not significantly different from low mathematical ability students.

Summary of the Findings

Based on the results of the analysis of data presented in this chapter, the findings of this study revealed:

- i. Gender was found to have a significant effect on the students' achievement in quadratic equation, that is, there was a significant difference in the achievement of male and female students.
- ii. Mathematical ability was found to have a significant effect on students' achievement in quadratic equation.
- iii. No significant two-way interaction effect of treatment and gender on students' achievement in quadratic equation.
- iv. There was a significant two-way interaction effect of treatment and mathematical ability on students' achievement in quadratic equation.
- v. No significant two-way interaction effect of gender and mathematical ability on students' achievement in quadratic equation.
- vi. No significant three-way interaction effect of treatment, gender and mathematical ability on students' achievement in quadratic equation.

Conclusion

The following conclusions are made based on the findings of this study. The results of this study provided the empirical evidence that mathematical ability moderated the use of computer as drill-and-practice to enhance students' achievement in quadratic equation. Thus, the effectiveness of computer in teaching quadratic equation depends on the mathematical ability of the students, while gender did not moderate students' achievement in quadratic equation using drill-and-practice and tutorial mode of computer assisted instruction.

Recommendations

The following recommendations were made based on the findings of this study

- i. Students' mathematical ability should be strengthened since it moderated students' achievement in quadratic equation.
- ii. Workshops/seminars should be organized by the government for mathematics teachers to enable teachers learn how to use computer in teaching mathematics especially quadratic equation.
- iii. Computers should be made available in schools, by the Government so that every student will have access to computers and make use of them in learning.

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