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COMPUTER ASSISTED INSTRUCTION AND MASTERY LEARNING STRATEGY AS DETERMINANTS OF SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS

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Abstract

This study investigated Computer Assisted Instruction (CAI) and Mastery Learning Strategy (MLS) as Determinants of Senior Secondary School Students' Achievement in Mathematics. The study adopted a quasi-experimental research design of pretest posttest non-equivalent control group with a sample size of 350 male and female students. A mathematics achievement test (MAT) with reliability coefficient of (α=0.84) was used to collect data. Three research questions were answered using mean and standard deviation while the three research hypotheses were tested using analysis of covariance (ANCOVA) at 0.05level of significance. The findings were thus: There was a significant main effect of treatment (CAI, MLS, TM) on students' achievements in mathematics. There was a significant main influence of gender on students' achievement in mathematics. There was no significant interaction effect of treatment and gender on students' achievement in mathematics. Based on the result of the study, it was recommended that CAI and MLS should be applied in teaching mathematics in secondary schools to contribute significantly to the achievement of students.

Introduction

Mathematics is known as a core subject that cuts across all other subjects due to its importance. Mathematics as a creation of the human mind (Awofala & Nneji, 2011) is the language of precision (Awofala, 2010) and whetstone of creativity, thinking and problem solving needed basically to bring synchronization, precision, compactness, and accuracy into the knowledge of science, technology, engineering and their byproducts (Awofala, Arigbabu & Awofala, 2013). The

significance of mathematics to nation building has led the Federal Government of Nigeria to make mathematics a core subject to be offered by students at all primary, junior secondary school and senior secondary school levels of education in Nigeria (FRN, 2013) in line with the Universal Basic Education System.

Furthermore, it is noted by Okafor (2012) that mathematics is compulsory for entry requirement into university education. Mathematics is a pre-requisite subject for professions like medicine, pharmacy, nursing, architecture, fashion designing, creative art engineering, land survey, property management, banking, public procurement, and advertising among others. The importance of studying mathematics to man and society at large can't be over emphasized. In this regard, it is found that the subject is made compulsory for all college students from primary to tertiary level. Despite the benefits accruing from mathematics, research findings have published a continuing devastating performance in the subject at all levels (Yusuf, 2010; John, 2011). The performance of students in mathematics extends to the future because mathematics is an aspect of daily living. Therefore, for there to be an excellent performance on the part of students, mathematics as a subject must be taught very carefully and systematically. In this study the efficacy of computer assisted instruction and mastery learning strategy will be reviewed to boost students' achievement in mathematics.

The report of the Chief Examiners, West African Examinations Council (WAEC, 2010) revealed that there was no significant improvement in the performance of candidates in mathematics. It was observed that some aspects of the course outline were poorly handled by the candidates. In another related observation by the Chief Examiner (WAEC, 2010) the problems affecting students' mathematics achievement can be related to teacher's methods of presenting the contents to the students. The teaching of mathematics involves the use of different methods (Oluwele & Ahmed, 2015). Mathematics is taught at different levels of school education. No one single method is fully suitable or appropriate for each level. Thus, different methods are used for the students of the different levels. There are different methods of teaching mathematics at primary, secondary and higher-level education as the students of each level differ in age, maturity, mental abilities, mental development, mathematical understanding and so on. Therefore, one method cannot be applied to teach mathematics at all the levels. Besides this, with the use of one method, all the students of a class or level cannot be equipped with equal amount of knowledge because individual differences lie among them. An individual difference is an important psychological phenomenon which affects teaching and its outcome to a great extent.

The teaching and learning of mathematics are very crucial, as every aspect of life depends largely on it. Hence, mathematics teachers should ensure that it is properly taught and not handled with any form of levity and carelessness since it is an essential part of everyday life of a student or learner. Teachers of mathematics should be well grounded in the field of mathematics and well trained to have mastery of the subject and be able to incorporate ICT in their activities to teach the subject effectively and efficiently. Teaching and learning have gone beyond the use of "chalk and talk" method as the only means of communicating ideas to learners as well as gaining subject

mastery; especially in a mathematics class. There is now the use of ICT devices, visual and audio-visual aids, and lots of learning strategies (LS) such as mastery learning strategy (MLS) to increase the learning outcomes of the students.

Computer Assisted Instruction (CAI) is an interactive instructional method whereby a computer is used to present the instructional materials and monitors the learning that takes place. It uses a combination of text, graphics, sound and video in the learning process (Onasanya, Daramola & Asuquo, 2006). Computer-based learning has the potential to make easy development of students' decision-making and problem-solving skills, data processing skills, and communication capabilities. By using computer, students can gain access to expansive knowledge links and broaden their exposure to diverse people and perspectives. Computer Assisted Instruction (CAI) can refer to virtually and kind of computer use in educational settings including drill and practice, tutorials, simulations, instructional management, supplementary exercises programming, database development and other applications (Cotton, 2011). Chang (2013) reported a significance increase in scores on a measure of academic achievement when CAI on arithmetic was used to teach addition and subtraction. This study indicated that CAI could have a positive effect on secondary students' skills and achievement. Students receiving computer – based instructions tended to learn faster. Afolabi (2009) who in his study reported that for mathematics, computer Assisted Instruction was very superior in increasing students' academic achievement and retention. This also supported other findings (Awofala, etal, 2013; Awofala, Fatade & Olaoluwa, 2013; Awofala, Balogun & Olagunju, 2011) which associated improved content learning to learner centered teaching strategies.

Mastery learning has been defined in many ways. It is an instructional process that provides students with multiple opportunities to demonstrate content mastery (Candler, 2010). It is distinctive compared to the traditional method of teaching in that the unit of material is taught and students' comprehension is assessed before they are allowed to move on to the next unit. It is an instructional method, where students are allowed unlimited opportunities to demonstrate mastery of content taught. Mastery learning strategy involves breaking down the learning, each with its own objectives. The strategy allows students to study materials unit after unit until they master it. It also helps students to acquire pre-requisite skills to move to the next unit. This strategy divides subject matter into units that have pre-determined objectives or unit expectations. Students individually or in groups work through each unit in an organized fashion. Teachers also do task analysis, thereby becoming better prepared to teach the units. In this case, learners will learn and benefit maximally from the instruction. Wambugu and Changeijwo (2008) in their research found that the students who were taught through mastery learning teaching strategy achieved statistically significantly higher scores compared to those who were taught through the traditional method. It is found that mastery learning is a strategy that significantly increases achievement.

The traditional method is teacher–centered method, which is seen as the traditional "talk and chalk" method of teaching. Here the teacher does the talking while the students serve as receivers only by listening and taking down notes (Adeniyi & Awofala, 2023). Obeka (2009) described the

traditional method as a teacher centered method. This leads to a classroom teaching environment, which is teacher dominated, didactic, textbook bound and examination oriented. Kelly (2009) affirmed that traditional method of teaching involves the teacher using verbal presentation of ideas or concepts. In this method, the teacher does more of the activities in the form of talking and writing on the board while the students listen. Onyezuligbo (2013) also observed that the mathematics classroom in Nigeria has been typified by traditional patterns of teaching and learning which have remained unchanged for decades. On this, Michael (2012) also noted that poor textbooks, which do not appeal to the interest of students and lack of computer technology in schools, are also responsible for poor performance, dwindling achievement, and negative attitude of students in mathematics.

Gender is often considered a common construct in the field of mathematics education and often mathematics is regarded as a masculine domain subject. The relation between gender and achievement in mathematics also presents a somewhat inconclusive finding (Awofala, 2017). Evidence suggests that there was a relationship between gender and achievement in mathematics (Awofala, 2017a; Akinsola & Awofala, 2009; Awofala, 2010; Fatade, Nneji, Awofala & Awofala, 2012). Hydea and Mertzb (2009) revealed that girls have reached parity with boys in mathematics performance, including at high school where a gap existed in earlier decades and affirm that girls are doing better than boys even for tasks that require complex problem solving. Thus, there is the need to accord boys and girls the same opportunities and challenges in the teaching and learning of mathematics. Based on this background, this study investigated the efficacy of computer assisted instruction and mastery learning approach on students' achievement in mathematics using gender as a moderator variable.

Research Questions

RQ1. What is the main effect of treatment (CAI, MLS, TM) on students' achievement in mathematics?
RQ2. What is the main influence of gender on students' achievement in mathematics?
RQ3. What is the interaction effect of treatment (CAI, MLS, TM) and gender on students' achievement in mathematics?

Research Hypotheses

The following null hypotheses were tested at 0.05 level of significance in order to provide answers to the problems raised in the study.
Ho_1: There is no significant main effect of treatment (CAI, MLS, TM) on students' achievement in mathematics.

Ho_2: There is no significant main influence of gender on students' achievement in mathematics.

Ho_3: There is no significant interaction effect of treatment (CAI, MLS, TM) and gender on students' achievement in mathematics.

The Conceptual Framework

The foundation upon which this conceptual framework is built is on a system of a process of input and output; whereby the worth of input determines the quality of the output. There is an assumption that the students' failures and poor achievement are a consequence of poor quality of instruction and not a function of lack of student's ability to learn concepts. This study reflects achievement in mathematics which is considered as the output of instruction through CAI, MLS, and TM. It also reflects the influence of the teacher and the influence of gender on students' achievement in mathematics as a moderator variable. The school used in this study is a coeducational senior secondary school, with slightly approximately same age of students. The study made use of professionally qualified mathematics teachers to control the teacher variable. This study adopted the CAI, MLS and TM teaching strategy which invariably influenced the (achievement) learning outcomes of the students used. The Conceptual framework (figure I) illustrated how the instructional strategy (teaching and learning methods) used by the teacher are determinants of senior secondary school students' learning outcomes in mathematics, with special reference to their achievement in mathematics.

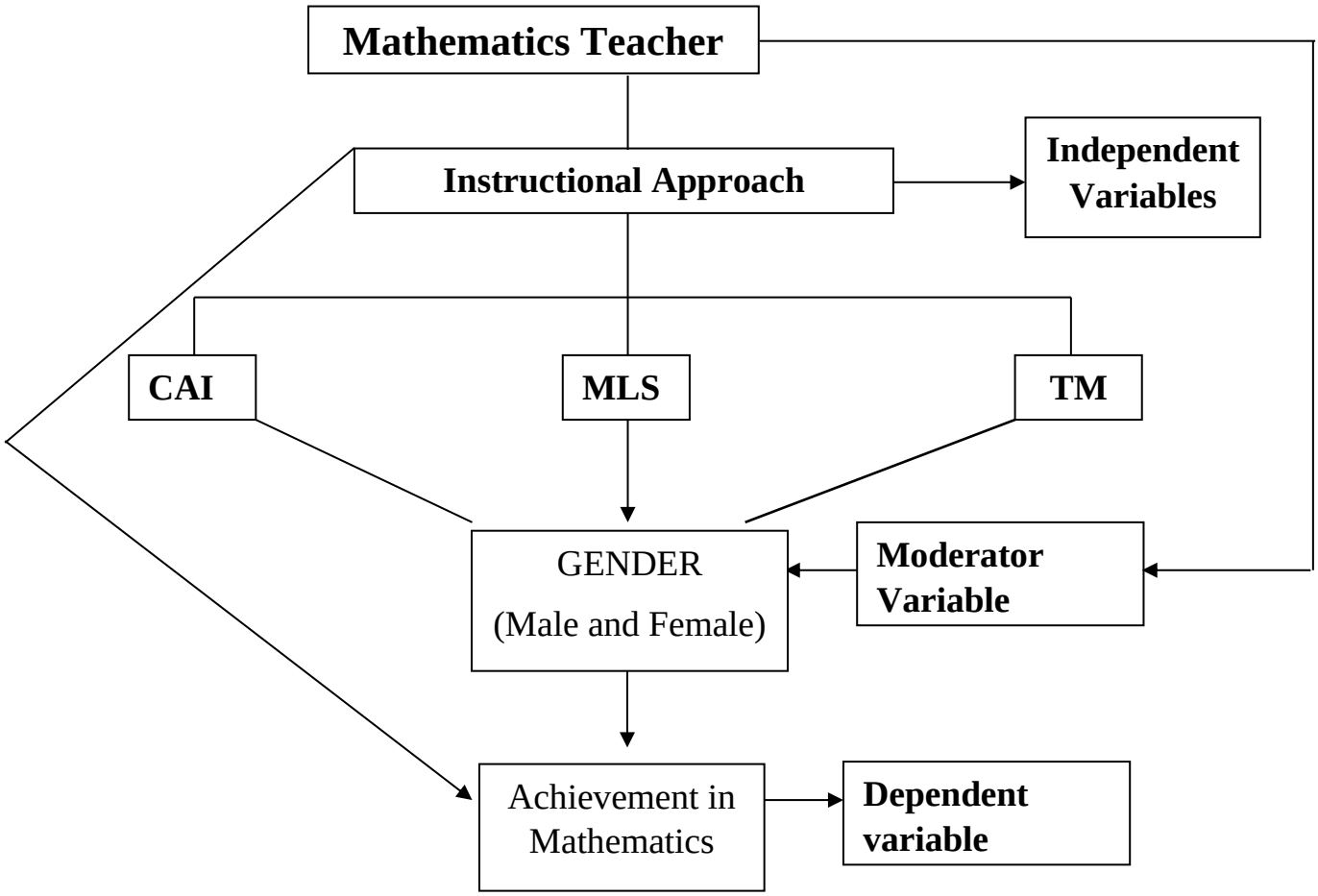

Figure I. Conceptual Framework

Method

Research Design

The research design adopted for this study was a quantitative method within the blueprint of quasi-experimental pretest, posttest non – equivalent control group design. The quasi-experimental design allows identification of variables. The quasi–independent variable of instructional strategy was manipulated at three levels (CAI, MLS & TM) while the quasi – moderator variable; gender was at two levels (Male and Female) and answering the research questions and testing the null hypotheses for the study required data that allow assessment of the extent to which the CAI, MLS, and TM influence students achievement in mathematics.

The research design is symbolically illustrated below.

O_1 X_1 O_2 X_1 difference = $O_2 - O_1$ O_1 O_3 O_5 = pre – test

O_3 X_2 O_4 X_2 difference = $O_4 - O_3$ O_2 O_4 O_6 = post – test

O_5 X_3 O_6 X_3 difference = $O_6 - O_5$

X_1, X_2 and X_3 represent CAI treatment, MLS treatment and TM treatment respectively. This mean the difference scores between O_1 and O_2, O_3 and O_4 and O_5 and O_6 were tested for statistical significance using the Analysis of Covariance (ANCOVA).

Participants

A total of three hundred and fifty (350) senior secondary school class two (SS2) mathematics students (140 male; 210 female) constituted the sample of the study. Simple random sampling was used to select an intact class each from five coeducational secondary schools that were distinctly located from one another. Two schools each were assigned to CAI and MLS respectively and the rest to the Traditional method (TM); with the average mean ages of students as 16 years.

Instrumentation

Mathematics Achievement Test

Mathematics Achievement Test (MAT) was the instrument used for the study. The MAT is a multiple-choice objective test with one key and three distracters. It has two sections A and B. Section A seeks personal information on the student with respect to gender and name of school. Section B consists of twenty (20) multiple choice objective test items. Each test item is followed by four options (A – D) from which the student was expected to select the correct alternative. Test contents covered the course content for study in three levels of cognitive domain of remembering (Knowledge), Understanding (Comprehension & Application) and thinking (Analysis, Synthesis, & evaluation). The content of the items covered topics like, linear equations and simultaneous equations. The validity of the MAT was ensured using a table of specification. In knowledge level question, students must observe, remember, and recall them, symbols, formula, definition, fact, and principles. In skill level question, they must apply knowledge and understanding of mathematics to unfair situation and in this type of question students need to find pre–requisite term and values. In comprehension level question, students must develop understanding of the terms, symbols, concepts, and facts. In application on solving by mastery learning strategy, they must

apply their knowledge, understanding and skill which occurred in new situation. The MAT was compiled from a random selection of standardized tests of WAEC past question papers and SS2 Student's textbooks, which were properly selected and vetted for administration.

Procedure

Before conduction of experiments, formal approval was sought from the head of school where experiment was to be done. After getting permission, experimental process was started. The study covered a period of 4 weeks with control group being taught with conventional traditional method and experimental groups with CAI and MLS. In control group the teachers covered the topics related to linear equations and simultaneous equations. The instructional lesson plan in the control school was different from the one in the experimental schools in presentation. The presentation in the control school followed the routine conventional traditional activities in which the traditional mathematics instruction involved lesson with lecture and questioning methods to teach the concepts related to linear equations and simultaneous equations. The control schoolteacher worked examples on the chalkboard about linear equations and simultaneous equations, and after their explanation; participant discussed the concepts and examples with teachers – directed question. The classroom instruction in the control class was two periods of 80 minutes each per week.

In experimental group the mathematics teachers were given comprehensive orientation on the principles behind CAI and MLS instructional strategies and contents areas for the study discussed. They were free to ask questions and offer suggestion on how best this modern approach could successfully be implemented in the school.

The teachers were trained for a period of two hours per day for two days on the use of MLS after which they were assessed through Micro Teaching exercise in the preparation of the MLS lesson. Each of the trained mathematics teachers led the teaching of the participant in their respective schools using the MLS instructional approach strategy to ensure fidelity of treatment and intactness of the MLS classes. The procedural steps or techniques for implementing mastery learning strategy include the following: Setting demonstrable learning goals; Creation of effective groups for collaborative work among students, provision of anchor task, monitoring students' progress carefully and provision of additional support for struggling students. The instructional plan consisted of introduction, objectives, contents, presentation, Evaluation and conclusion in the MLS classes The MLS group adopted the mastery learning strategy principles of moving from one unit to another due to gain of mastery on subjects' matter/contents. For CAI strategy researchers sought the consent of the management of the CAI schools and approvals were given to conduct the study in the schools. The nature and purpose of the research were then explained to the mathematics teachers who computer literates were and who showed willingness and readiness to participate in the study. The mathematics teachers were to be computer literate because the CAI enacted in this study involved the use of computer. The highlights of the weekly activities that would be carried out and the extent of their involvement were discussed with them. The mathematics teachers were then given comprehensive orientation on the principle behind the CAI as an instructional strategy that involves online/offline program-based instruction and face to face interaction and content areas for the study discussed. They were free to ask question and offer suggestion on how best this modern approach could successfully be implemented in the school. The teachers were trained just like their counterparts in mastery learning strategy schools after which they were assessed through micro teaching exercise in the preparation of the CAI lesson. The computer assisted instructions

(CAI) were developed by dividing the whole content into different task, which were presented in form of Microsoft Power Point Presentations. After completing it, each question was posted there to test the understanding and learning of the participants. Appropriate background, colouring and pictures were ordered to make instructions more interesting. The treatment conditions were concluded in all the CAI, MLS, and TM schools in the fourth week after which they were administered the posttest organized version of the pretest in order to prevent hallo effect which could result from over familiarization with the pretest field work activities.

Data Analysis

The research questions were answered together with the hypotheses with the use of inferential statistics of Analysis of Covariance (ANCOVA). The post-treatment achievement scores were subjected to analysis of covariance using the pre-treatment achievement. All hypotheses were tested at a 0.05 level of significance.

Result

Research Questions

RQ1. What is the main effect of treatment (CAI, MLS, TM) on students' achievements in mathematics?

Table 1: Descriptive Statistic Showing Main Effect of Treatment on Students' Achievement in Mathematics

Treatment	***Pre-Achievement***		***Post-Achievement***		***Mean Difference***
	$\bar{X}$	**S.Dev**	$\bar{X}$	**S.Dev**	
CAI	13.78	3.075	17.95	1.860	4.17
MLS	13.91	2.987	17.31	2.663	3.40
TM	11.16	3.107	17.23	2.147	6.07
TOTAL	**12.95**	**3.056**	**17.49**	**2.223**	**4.55**

Table 1 showed the main effect of treatment (CAI, MLS, TM) on the student's achievement in mathematics and revealed that CAI had the highest post-test mean (Mean = 17.95, SD = 1.860) and mean difference of 4.17, this was followed by the post-test mean of the MLS (Mean = 17.31, SD = 2.663) with a mean difference of 3.40 while the TM recorded the lowest post-test mean (Mean = 17.23, SD = 2.147) and the highest mean difference of 6.07. This shows that the CAI has the most effect on the student's achievement in mathematics.

RQ2. What is the main influence of gender on students' achievements in mathematics?

Table 2: Descriptive Statistic Showing Influence of Gender on Students' Achievement in Mathematics

Gender	*Pre-Achievement*		*Post-Achievement*		*Mean Difference*
	$\bar{X}$	S.Dev	$\bar{X}$	S.Dev	
Male	12.62	3.423	17.84	2.475	5.22
Female	13.17	3.209	17.27	2.090	4.10
TOTAL	**12.89**	**3.316**	**17.56**	**2.283**	**4.66**

Table 2 showed the main influence of gender on the student's achievement in mathematics and revealed that males had the highest post-test mean (Mean= 17.84, SD = 2.475) and a mean difference of 5.22, while the females had the lowest post-test mean (Mean = 17.27, SD = 2.090) with a mean difference of 4.10. This shows that the male gender performed better in mathematics achievement than the female gender.

RQ3. What is the interaction effect of treatment (CAI, MLS, TM) and gender on students' achievement in mathematics?

Table 3: Descriptive Statistic Showing Interaction Effect of Treatment and Gender on Students' Achievement in Mathematics

Treatment	Gender	*Pre-Achievement*		*Post-Achievement*		
		$\bar{X}$	S.Dev	$\bar{X}$	S.Dev	*Mean Difference*
CAI	Male	13.38	3.393	18.36	2.024	4.98
	Female	14.04	2.851	17.69	1.712	3.65
MLS	Male	13.79	3.182	17.71	2.798	3.92
	Female	14.00	2.859	16.88	2.525	2.88
TM	Male	10.63	2.831	17.46	2.474	6.83
	Female	11.51	3.246	17.21	1.919	5.70

Table 3 showed the interaction effect of treatment and gender on students' achievement in mathematics and revealed that for the CAI treatment; males had the highest post-test mean achievement (Mean = 18.36, SD = 2.024), despite having the lowest pre-achievement mean score of (Mean= 13.38, SD = 3.393) while the females had the lowest post-test mean achievement of (Mean= 17.69, SD = 1.712) and pre-test mean achievement of (Mean= 14.04, SD = 2.851). Data on the MLS treatment showed that males had again the highest post-test mean achievement of (Mean= 17.71, SD = 2.798), despite having the lowest pre-achievement mean score of (Mean= 13.79, SD = 3.182) while the females had the lowest post-test mean achievement of (Mean= 16.88,

SD = 2.525) and pre-test mean achievement of (Mean= 14.00, SD = 2.859). Lastly, the data on the TM treatment showed that males once again had the highest post-test mean achievement of (Mean= 17.46, SD = 2.474), despite having the lowest pre-achievement mean score (Mean= 10.63, SD = 2.831) while the females had the lowest post-test mean achievement of (Mean= 17.21, SD = 1.919) and pre-test mean achievement of (Mean = 11.51, SD = 3.246).

Null Hypotheses

Ho_1: There is no significant main effect of treatment (CAI, MLS, TM) on students' achievements in mathematics.

Ho_2: There is no significant main influence of gender on students' achievements in mathematics.

Ho_3: There is no significant interaction effect of treatment (CAI, MLS, TM) and gender on students' achievement in mathematics.

Table 4: ANCOVA analysis showing the main effect of treatment, Influence of gender and interaction effect of treatment and gender on students' achievements in Mathematics.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	70.318[a]	6	11.720	2.336	.032	.039
Intercept	5738.363	1	5738.363	1143.558	.000	.769
PRESCORE	.626	1	.626	.125	.724	.000
Treatment (T)	37.643	2	18.822	3.751	.024*	.021
Gender (G)	27.287	1	27.287	5.438	.020*	.016
T *G	5.276	2	2.638	.526	.592*	.003
Error	1721.171	343	5.018			
Total	108909.000	350				
Corrected Total	1791.489	349				

a. R Squared = .039 (Adjusted R Squared = .022)

b. Dependent Variable: Post-Test Score Experimental

Table 4 showed the ANCOVA analysis showing the main effect of treatment, influence of gender and interaction effect of treatment and gender on students' achievement in mathematics. The table showed that the observed differences in the means among the three treatments (MLS, CAI, TM) were statistically significant ($F_{(2, 348)} = 3.751$, $p=0.024$, $\eta^2p = .021$). This significance was tested at a 0.05 significant level which means that there was a less than 5% chance that the result obtained was due to randomness. This means that there was a 95% chance that the difference in the effect of the three treatments on the achievement score was a real difference and did not occur by mere chance. Furthermore, the partial eta squared (η^2p) which is the proportion of the effect + error variance that is attributed to the effect (Awofala, Fatade & Udeani, 2015) was just .021 in this study, which means that the factor treatment by itself accounted for just 2.1% of the overall (effect + error) variability in the students' achievement score in mathematics. Hence, the null hypothesis one was rejected in order to accept the alternative hypothesis. This means that there is a significant mean effect of treatment (CAI, MLS, TM) on students' achievement in mathematics.

Also, hypothesis two tested showed that the observed differences in the means among the two gender was statistically significant ($F_{(2, 348)} = 5.438$, $p=0.020$, $\eta^2p = .016$). This significance was tested at a 0.05 significant level which means that there was a less than 5% chance that the result obtained was due to randomness. This means that there was a 95% chance that the difference in the male and female achievement score was a real difference and did not occur by mere chance. Furthermore, the partial eta squared (η^2p) which was just .016 in this study, which means that the factor treatment by itself accounted for just 1.6% of the overall (effect + error) variability in the students' achievement score in mathematics. Hence, the null hypothesis two was rejected to accept the alternative hypothesis. This means that there was a significant main influence of gender on students' achievement in mathematics. Lastly, hypothesis three tested showed that the observed interaction effect of treatment and gender on students' achievement in mathematics was statistically not significant ($F_{(2, 348)} = 0.526$, $p=0.592$, $\eta^2p = .003$). Hence, the null hypothesis three was accepted that there was no significant interaction effect of treatment and gender on students' achievement in mathematics.

Table 5: Bonferroni Comparison of Treatments Mean Score in Mathematics

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
CAI	MLS	.722*	.299	.049	.002	1.442
	TM	.726	.318	.070	-.040	1.492
MLS	CAI	-.722*	.299	.049	-1.442	-.002
	TM	.004	.319	1.000	-.763	.770
TM	CAI	-.726	.318	.070	-1.492	.040
	MLS	-.004	.319	1.000	-.770	.763

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

c. Adjustment for multiple comparisons: Bonferroni.

d. Dependent Variable: Post-Test Score Experimental

Table 5 shows the post hoc test of the effect of the treatment (CAI, MLS, TM) on the students' achievement in mathematics to see which of the treatment actually causes the significant effect reported. It was discovered that both the CAI and MLS contributed significantly towards the improved achievement of the students in mathematics while the TM was not. Thus, it is concluded that computer-assisted instruction and mastery learning strategy have significant effects on the students' achievement in mathematics.

Discussion

The present study found that there was a significant main effect of treatment (CAI, MLS, TM) on students' achievement in mathematics. This finding supported the report of Duru (2010) who confirmed that students who were taught mathematics with traditional method only do not perform better in mathematics; that is to say, they recorded a low achievement in mathematics. Also, the result agreed with the findings of Awofala (2020), Yusuf and Afolabi (2010) and Afolabi (2009)

who in their study reported that computer assisted instruction was very superior in increasing students' academic achievement, and retention. This finding supported the findings of some researchers (Awofala, etal, 2013; Awofala, Fatade & Olaoluwa, 2012; Akinsola & Awofala, 2008; Awofala, 2016; Ojaleye & Awofala, 2018; Olabiyi & Awofala, 2019; Awofala & Lawani, 2020a; Awofala & Lawani, 2020b; Lawal & Awofala, 2019; Awofala, 2011a; Awofala, Fatade & Olaoluwa, 2013; Awofala, Balogun & Olagunju, 2011; Awofala, 2017b; Lawal & Awofala, 2021) which associated improved contents learning to learner centered teaching strategies. The conventional or traditional teaching method had not only been criticized for emphasizing teacher activity at the expense of pupil involvement; this is to say that the traditional method is teacher oriented in nature (Adeniyi & Awofala, 2023; Awofala, 2011; Awofala, et, al, 2013) but that it had a negative effect on students' achievement in mathematics. In this work, it was discovered that both the CAI and MLS contributed significantly towards the improved achievement of the students in mathematics. This means that there will always be a great change; a positive shift in the achievement of the students who do not only get exposed to the old and archaic traditional talk and chalk teaching method or strategy which is already in its obsolete mode. Thus, it is concluded that computer-assisted instruction and mastery learning strategy have significant effects on the students' achievement in mathematics.

The influence of gender on students' achievement in mathematics was also noticed. Male students performed better than their female counterparts in mathematics. This suggests that there is still a gap to be bridged between the moderator variable; which is gender (Awofala, 2011b) and this can be achieved with the help of viable teaching strategies that have been proven to have efficacy in solving the age long gender disparity. It will suffice to mention or recommend that CAI and MLS be adopted as strategies to gain this ground of solution. Also, the result of the present study suggests the existence of differential experience of boys and girls within and outside the classroom (Awofala et al., 2013) and that gender difference in achievement in mathematics might not have all disappeared (Awofala, 2008; Awofala, 2017a).

One can also infer that there was no significant interaction effect of treatment and gender on students' achievements in mathematics. The finding supported Tuatongba (2007), Anemelu (2012) and Oluwele and Ahmed (2015) submissions on the non-significant interaction effect of treatment and gender on students' achievement in mathematics in their separate studies. They found no significant interaction effect of treatment and gender difference between the mean achievements score of male and female students taught with computer assisted instructional package. This finding was also in agreement with the finding of some researchers (Awofala et al., 2013, Awofala & Nneji, 2011) who had found non – significant interaction effect of treatment and gender on students' learning outcomes in mathematics and science.

Conclusion

The findings from this work reveals that, there was a significant main effect of treatment (CAI, MLS, TM) on students' achievement in mathematics. It was revealed that both the CAI and MLS contributed significantly towards the improved achievement of the students in mathematics.

It will also suffice to reference or recommend that CAI and MLS be adopted as strategies to close the gap of gender disparity as the strategies have been proven to possess efficacy to do so.

Thus, it was concluded that computer-assisted instruction and mastery learning strategy have significant effects on the students' achievement in mathematics. There will always be a drastic, dramatic change; and a holistic shift in the achievement of the students who do not only get taught

with the antiquated traditional talk and chalk teaching strategy which is already in its antediluvian mode.

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