EFFECTS OF COMPUTER-SELF INTERACTIVE PACKAGE (CSIP) ON STUDENTS' PERFORMANCE, ACHIEVEMENT LEVEL AND ATTITUDE TOWARD MATHEMATICS AT SECONDARY SCHOOL IN NIGERIA

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Abstract
Students' performance in Mathematics in secondary school Education in Nigeria remains poor. Consequently, the West Africa Senior Secondary School Certificate Examination (WASSSCE) Mathematics results continue to cause concern to all the stakeholders in the education sector. Therefore, there is serious and urgent need for intervention. Although research has indicated that computer-assisted instruction (CAI) enhances students' achievement, promotes positive attitudes towards Mathematics instruction, and improves interpersonal relations. The purpose of this study was to investigate the effects of CSIP on students' performance, achievement level and attitude towards mathematics among second year students (SSII) who received instruction using CSIP. The quasi-experimental design involving pretest – posttest experimental control group was adopted. Two SSII intact classes were selected at random and 92 students participated in the study. A validated Algebra Achievement Test (AAT) with 0.72 reliability coefiicient was used for collecting data. Results indicated higher achievement and positive attitudes for students in CSIP treatment groups. Higher achievers in CSIP group performed better than medium and low achievers respectively. Also, the CSIP was found to be gender (male and female students performed better). Based on the findings, CSIP should use for teaching algebra to improve students' performance and reinforce positive attitudes towards mathematics.

Keywords: *Computer-Self Interactive Package; Algebra, Achievement Level, Gender; Attitude.*

Introduction

Mathematics is a bridge to science, technology and other subjects offered in any formal educational system. The teaching of mathematical concepts and skills that students encounter in school shapes their understanding, their ability to solve problems and their confidence in, and disposition toward Mathematics (Too, 2007). The importance 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 levels of education in Nigeria (FRN, 2013). Okafor (2002), notes that pass at credit level in mathematics at Ordinry Level (O' Level) is one of the prerequisite for entrance into Nigerian university. A close examination of the performance of students' in Nigeria in the West African Senior Secondary Certificate Examination (WASSCE) results of ten consecutive years revealed that most students may not get admission into university owing to their failure to obtain pass at credit level in mathematics (WAEC, 2015).

A lot of challenges abound in the teaching and learning of Mathematics in Nigeria. Several studies and reports have established the causes of the appalling state of Mathematics (WAEC, 2015). These causes were identified as: negative attitude of students towards Mathematics, lack of appropriate teaching methodology, inadequate assignments to students, and inadequate coverage of syllabus. Nigerian classrooms are dominated with traditional teaching methods which produced low passing rates in mathematics courses at all levels of education Okafor (2002) and Okeke (2001) identify poor teaching methods as the major factor contributing to the poor performance of students in mathematics. There is need to try alternative instructional approaches to improve the teaching of mathematics with the goal of increasing the number of students who have the skills and knowledge required for college-level mathematics courses and for the twenty-first century workforce. The concepts of algebra were identified as one of the problematic concepts poorly taught from the year 2010 - 2015 West Africa Senior Secondary School Certificate Examination (WASSSCE) Mathematics Papers 1 and 2 (WAEC, Chief examiners' reports, 2015).

Research studies across the globe have focused on how to improve achievement of students at all levels using computer for classroom learning. It was against this backdrop that the present study chose to explore the use of computer assisted instruction (CAI) in the delivery of Mathematics. The main concern was to explore approaches that would ultimately improve the state of Mathematics performance at secondary school level. Studies on CAl have shown positive effects on achievement. For instance, the research on the effects of computer-assisted instruction on the mathematical learning of students of various ability levels suggests that computer-assisted instruction as a supplement to traditional classroom instruction is more effective than traditional instruction alone (Brothen & Wambach, 2000; Butzin, 2000; McSweeney, 2003; Nguyen, 2002; Olusi, 2008). Anyamene, Nwokolo, Anyachebelu and Anemelu (2012) and Mahmood (2006) concluded that traditional instruction supplemented with computer-assisted instruction resulted in students' higher mathematical performance than traditional instruction. Studies showed that using CAI for supplemental algebra instruction with middle and high school students had positive effects on achievement and attitude (Bassoppo-Moyo, 2010; Hegedus & Kaput, 2004; Nicaud, Bitta, Chaachoua, Inamdar, & Maffei, 2006). Similarly, Stillson and Alsup (2003) studied the effectiveness of teaching Basic Algebra using the interactive learning system to supplement traditional instruction. They found that students liked the immediate feedback, the repetition, and the convenience of working at their own pace. Those who used the software thought they learned more than in previous math courses when software was not used. Mwei, Too, and Wando (2011) reported higher achievement and positive attitudes with CAI treatment groups.

However, other studies comparing traditional instruction to traditional instruction supplemented by computer-assisted instruction for mathematics students also indicated that there were no significant differences in the learning outcomes of students' taught mathematics using computer-assisted instruction and those taught with traditional methods (Jacobson, 2006; Kinney, 2001; Reagan, 2004; Waycaster, 2001). Similarly, Kathy (2009) found that there was no statistically significant difference in the posttest scores of students receiving traditional instruction and traditional instruction supplemented with computer-assisted instruction. However, findings on use of CAI for teaching mathematics are inconclusive. Most of these studies were conducted outside Nigeria and did not examine the influence of gender and achievement levels when students were exposed to computer-assisted instruction. In this modern day of dominating influence of the computer, therefore, there is need to examine the effects of CAI with interaction effects of gender and achievement levels within the Nigerian school context on students' performance.

Gender has been identified as one of the factors influencing students' performance at Secondary School level in Nigeria (Anagbogu, & Ezeliora, 2007; Eze, 2010). The performance of students in science and mathematics in the Nigerian educational setting seems to be gender sensitive. However, research efforts focusing on gender issue in science and mathematics have produced conflicting results. Some findings indicated that significant differences existed between the performance of male and female students while other findings showed that gender factor had no influence on students' performance (Yusuf, 2004). For instance, Annetta, Mangrum, Holmes, Collazo and Cheng (2009) and Kathy (2009) reported a significant difference in the posttest scores of females and males, with female outperformed male students in mathematics, chemistry and science process skills respectively. In addition, Orabi (2007) reported that female students were able to learn the engineering material as effectively as the male students. Contrarily, Anyamene, Nwokolo, Anyachebelu and Anemelu (2012) and Gambari and Zubairu (2008) reported no significant difference in the post-test achievement scores of male and female students taught mathematics using CAI package. Olowe (2009) and Umar (2011) reported no significant difference between male and female students taught biology with computer assisted instruction packages. Based on these conflicting results, part of this study examined the influence CAI on male and female students' performance in mathematics.

Achievement levels of the students greatly influence learning outcomes. For instance, Aluko (2004) and Yusuf (2004) state that despite the lumping together of the three (high, medium and low abilities) the high

ability students do perform better than low ability students in conventional classrooms. Similarly, Emeke and Adegoke (2001), Condron (2003), Falaye (2006), Adewale (2008), Denessen, Veenman, Dobbelsteen and Vanschilt (2008), Karademir (2009), Hannafin and Foshay (2008); Yusuf, Gambari and Olumorin (2012) reported that high ability students performed better than low achiever students. However, Bangert-Drowns, Kullik, & Kullik (1985) reported that CAI was more effective for lower-achiever students. Muhfahroyin's (2009) result indicated no difference between higher and lower students' ability in the cognitive achievement of Biology, critical thinking and process skills. Similarly, Holmes and Ahr (1994) were of the view that ability grouping has no effect on students' achievement. Students' performance in mathematics can be influenced by their attitude as well as their motivation to achieve.

When students experience success in mathematics, their confidence in mathematics and overall attitude toward mathematics improves (Olson, 2002). Success in mathematics can reinforce positive feelings about students' abilities to do mathematics making them more willing to engage in more mathematics because they expect to be successful. Published empirical studies reported that students demonstrated more favorable attitude toward learning with computers than direct instruction (traditional method) (Chiu, 2007; Eklof, 2007; Hammouri, 2004; Wigfield & Eccles, 2002). More recently, Reed Drijvers and Kirschner (2010) found that attitude towards computer use was positively related to achievement in lower ability students. Bassoppo-Moyo (2010) revealed students' attitudes and achievement levels were improved using CAI. After conducting interviews and administering questionnaires, they reported over 87% of the students reported liking mathematics and they intended to study it in future. Bassoppo-Moyo (2010) results were similar to Hegedus and Kaput (2004) and Nicaud et al (2006) who reported high levels of engagement as students interacted with software to improve algebraic reasoning.

Traditional teaching method had given insufficient opportunities for student to construct their own learning. Eliciting students' individual capabilities, intelligence and creative thinking can only be achieved through student centered instructional methods (Adegoke, 2011). Computer Assisted Instruction (CAI) in learning is fast gaining ground in developing nations like Nigeria. Computer-Assisted Instruction (CAI) software could be used to transform classroom instruction into a series of rich memorable experience and therefore reduce boredom and forgetfulness (Achuonye, 2011; Yusuf & Afolabi, 2010). CAI is a teaching process used to enhance a student's learning. It combines text, graphics, video and audio which may include interactivity options. However, little is known about the use of computer assisted instructional package in the Nigerian education system particularly for teaching and learning mathematics. Thus, much remain to be empirically studied on the influence of CAI based on gender and achievement levels in Nigeria.

Research Hypotheses

Ho_1: There is no significant difference between the mean achievement scores of students exposed Algebra concepts using CSIP and their counterparts taught using conventional teaching method.

Ho_2: There is no significant difference in the mean achievement scores of male and female students taught algebraic concepts using CSIP.

Ho_3: There are no significant differences in the mean achievement scores of high, medium, and low ability students taught algebraic concepts using CSIP.

Ho_4: There is no significant difference between students' attitude towards mathematics using CSIP and TTM.

Methodology

The research design adopted for this study is a quasi-experimental design. It is a pretest, posttest, non-equivalent, non-randomized control group (Fraenkel & Wallen, 2003). Two levels of independent variables (one treatment and a control), two levels of moderating variables (gender and achievement levels). Gender (male and female), and achievement levels (high, medium and low) were investigated on students' performance in Mathematics.

The target population of this study was the second year senior secondary school (SSSII) mathematics students in Minna metropolis of Niger State, Nigeria. The nature of the study required purposive selection of the research sample since a study on CAI must be conducted in schools where students are computer literate and computers are available and accessible for students' use. Two secondary schools were purposively sampled based on facilities (laboratories, ICT facilities and manpower), gender composition (co-educational schools). The two schools were randomly assigned to experimental group (Computer-Self Interactive Package, CSIP group) and control group (Traditional Teaching Methods, TTM) respectively. Ninety-two (92) students participated in the study (experimental group n = 44), (control group n = 48). Experimental group was stratified into gender (23 males and 21 females) and achievement levels (High = 14, Medium = 20 and Low = 10). Similarly, control group was stratified into gender (male = 28, female = 20) and achievement level (high = 12, medium = 22, low = 14). SSSII students were chosen for this study to avoid disruption of the preparations of the SSSIII students who were getting ready for their WASSSCE. The SSSIII students have already been taught the topic used for the study; hence they were not suitable for the study.

Three research instruments were employed: Computer-Self Interactive Package (CSIP) was used as a treatment (not for data collection), Algebraic Achievement Test (AAT) was employed as test instrument. Algebra Attitude Scale (ATS) used to elicit responses on students' attitude towards Mathematics after exposing to CSIP and TTM. CSIP was developed with the assistance of a computer programmer. It is an interactive package which contains contents of Algebraic process. It was structured in the following ways: Students log-in with their password, an introductory message welcoming the students to CSIP, followed by list of sub-topics to be selected by the students. On selecting the topic, objectives of the lesson will be displayed. This was followed by a short text in form of frame on the computer screen. The students read the text then a question based on it is followed with four (4) options (A) to (D) out of which the student picks one. A feedback of "correct" or "wrong" is given by the computer and the score of 1 mark is awarded for a correct answer for the students' first attempt.

The CSIP contains ten sub-topics. Each of the topics lasts for 40 minutes. The topics covered linear equations, word problems leading to linear equation, linear inequalities, word problems leading to linear inequality and subject of a formula. This package was used for experimental group. The sequence of text display, question and answer options, immediate feedback is provided until all the ten lessons were covered. CSIP was face and content validated by educational technology, mathematics, and computer programmer specialists.

Algebra Achievement Test (AAT) was used in collecting data for the study. The Algebra Achievement Test (AAT) consists of 50 multiple choice objective items with four options (A – D) adopted from past examinations of West African Examination Council (WAEC, May/June) and National Examination Council (NECO, June/July). AAT was validated by experts in Mathematics, test and measurement and its reliability coefficient determined as 0.86 using Kuder Richardson (KR-20).

Algebra Attitude Scale (AAS) was a researcher-developed questionnaire for eliciting response on students' attitude towards mathematics after they were exposed to CSIP and TTM. It is made-up of 4-point modified Likert scale consisting of 20-item questionnaire codes as 1, for Strongly Disagree, 2 as Disagree, 3 as Agree and 4 as Strongly Agree. AAS was face and construct validated by experts in Mathematics, test and measurement and its reliability coefficient determined as 0.72 using Kuder Richardson (KR-21).

The objectives and the modalities of the experiments were specified and operational guide was produced before the commencement of the treatment. The researcher administered the Algebra Achievement Test (AAT) on sample students as pretest to ascertain the equivalence of the students before the treatment. This was followed by administration of treatment which lasted for five weeks. Thereafter, AAT was administered as posttest to measure the achievement of the sample students in each school. The scores

obtained were analyzed based on the stated hypotheses, using Analysis of Covariance (ANCOVA). The significance of the various statistical analyses was ascertained at 0.05 alpha level.

Results

To test the hypotheses, the data obtained from AAT was analysed using Analysis of Covariance (ANCOVA) and Scheffe's post-hoc statistics. The results are presented based on the research hypotheses.

Ho_1: There is no significant difference between the mean achievement scores of students exposed to CSIP and their counterparts taught using conventional teaching method (TTM). To test this hypothesis, ANCOVA statistics was used to analyze the achievement scores. The summary of this analysis is as shown on table 1.

Table 1: ANCOVA of mean scores of students in experimental and control groups

Source of Variation	Type III Sum of Squares	df	Mean Square	F – value	p – value
Corrected Model	5997.708	2	2998.854	14.456	0.000
Intercept	48094.574	1	48094.574	231.847	0.000
Covariate (Pretest)	0.577	1	0.577	0.003	0.958
Main Effect (Treatment)	5970.074	1	5970.074	28.780*	0.000
Residual (Error)	18462.248	89	207.441		
Total	515020.000	92			
Corrected Total	24459.957	91			

*: Significance at 0.05 alpha level

Table 1 revealed that F (1, 92) = 28.780, p = 0.000 for the main effect (treatment) was significant. The results revealed that the computer-self interactive package (CSIP) produced a significant effect on the posttest achievement scores of students when covariate effect (pretest) was controlled. The result indicated that the treatment, using CSIP and TTM accounted for the difference in the posttest achievement scores of the students. This implies that a significant difference existed between the two groups of computer-self interactive package (CSIP) and traditional teaching method (TTM). Hence, the Hypothesis 1 was rejected.

To show the groups improvement in learning after treatment, the mean gain scores between the pretest and posttest mean scores of the two groups (CSIP and TTM) are presented in Table 2 and Figure 1.

Table 2: Mean gain scores of students taught algebra using CSIP and TTM

Group	Pretest	Posttest	Mean Gain Score
CSIP	19.82	81.45	61.63
TTM	18.83	65.29	46.46

From Table 2, it was observed that all the groups had improvement as observed in their posttest. For instance, CSIP had highest mean gain scores 61.63 while TTM had the mean gain scores of 46.46. This indicates that all the groups benefited from the treatment, with CSIP having the better posttest performance.

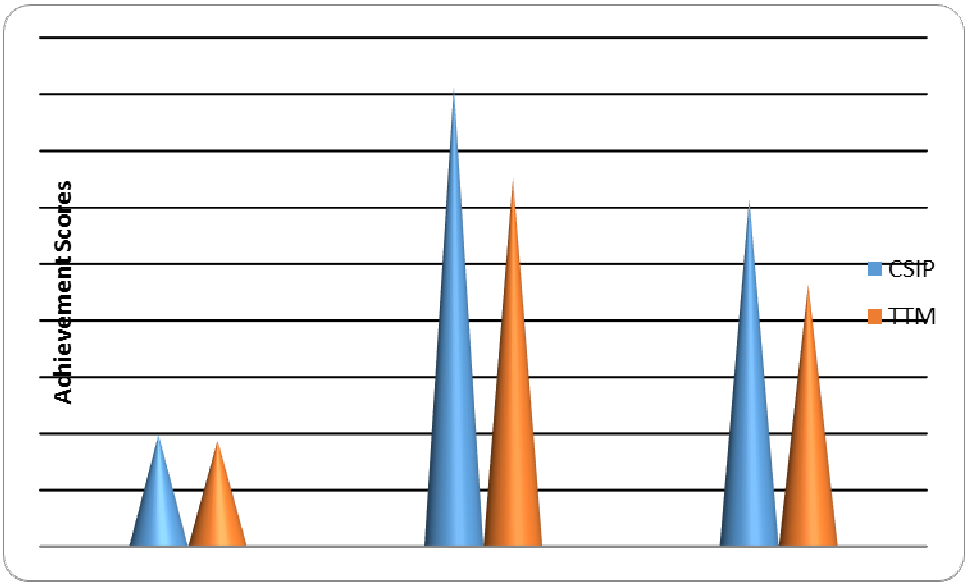

Fig. 1: Graphical illustration of students in CSIP and TTM groups at pretest and posttest

Ho_2: There is no significant difference between male and female students taught algebraic process using CSIP. To test this hypothesis, ANCOVA statistics was used to analyze the mean scores. The summary of this analysis is shown on table 3.

Table 3: ANCOVA results of male and female students exposed to CSIP

Source of Variation	Type III Sum of Squares	df	Mean Square	F - value	p – value
Corrected Model	284.909	2	142.454	0.771	0.469
Intercept	16226.718	1	16226.718	87.801	0.000
Covariate (Pretest)	157.733	1	157.733	0.853	0.361
Main Effect (Gender)	128.724	1	128.724	0.697^{ns}	0.409
Residual (Error)	7577.273	41	184.812		
Total	191688.000	44			
Corrected Total	7862.182	43			

ns: not significance at 0.05 alpha level

Table 3 revealed that F (1, 44) = 0.697, p = 0.409 for the main effect (Gender) was not significant. The results revealed that gender did not produce any significant different on the posttest achievement scores of students when covariate effect (pretest) was controlled. The result indicated that there was no significant difference between male and female students' performance in the posttest achievement scores. This implies that CISP is gender friendly. Hence, the Hypothesis was not rejected.

Ho_3: There are no significant differences among high, medium, and low achievement students taught algebraic process using CSIP. To test this hypothesis, the mean achievement scores of high, medium and low ability students were computed using ANCOVA statistics. The results are presented in tables 3

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Table 4: ANCOVA results of high, medium and low achiever students in experimental group

Source of Variation	Type III Sum of Squares	df	Mean Square	F – value	p - value
Corrected Model	8673.030	3	2891.010	81.101	0.000
Intercept	25698.386	1	25698.386	720.913	0.000
Covariate (Pretest)	56.178	1	56.178	1.576	0.217
Main Effect (Achievement Level)	8640.885	2	4320.442	121.201*	0.000
Residual (Error)	1425.879	40	35.647		
Total	302032.000	44			
Corrected Total	10098.909	43			

*: Significance at 0.05 alpha level

Table 4 revealed that F (2,44) = 121.201, p = 0.000 for the main effect (Achievement Level) was significant. The results revealed that the computer-self interactive package (CSIP) produced a significant effect on the posttest achievement scores of students when covariate effect (pretest) was controlled. The result indicated that the treatment, using CSIP and traditional teaching method (TTM) accounted for the difference in the posttest achievement scores of the students. This implies that a significant difference existed between the three groups (high, medium and low achiever students) taught Algebraic process using CSIP. Hence, the Hypothesis was rejected. Based on the established significant difference in the post-test scores of the groups, Scheffe's test was used for post-hoc analysis. The results of this post-hoc analysis are as shown in Table 5.

Table 5: Scheffe's post-hoc analyses of the groups mean scores

Groups	Mean Scores	Group I (High)	Group II (Medium)	Group III (Low)
Group I (High)	96.29		*0.000	*0.000
Group II (Medium)	82.80	*0.000		*0.000
Group III (Low)	58.00	*0.000	*0.000	

*: significant at 0.05 alpha level

The result in Table 5 indicates that there was significant difference in the mean achievement scores of high achievers exposed to CSIP (X = 96.29) and medium achievers exposed to CSIP (X = 82.80). It also indicates significant difference in the mean achievement scores of medium achievers exposed to CSIP (X = 82.80) and low achievers exposed to CSIP (58.00). Significant difference was also established in the mean achievement scores of medium achievers exposed to CSIP (X = 82.80) and low achievers exposed to CSIP (X = 58.00). To show the improvement in learning among the groups after the treatment, the mean gain scores between the pretest and posttest of the four groups (CSIP and TTM) are as shown in Table 6 and Figure 2.

Table 6: Mean gain scores of students taught algebra using CSIP

Group	Pretest	Posttest	Mean Gain Score
High	18.50	96.26	77.76
Medium	20.05	82.80	62.75
Low	21.20	58.00	36.80

From Table 6, it was observed that all the groups had improvement as observed in their posttest. For instance, High achiever students had highest mean gain scores 77.76; Medium achiever students had the mean gain scores of 62.75; followed by Low achiever students with the mean gain scores of 58.00. This indicates that all the groups benefited from the treatment, with high achiever students having the best posttest performance.

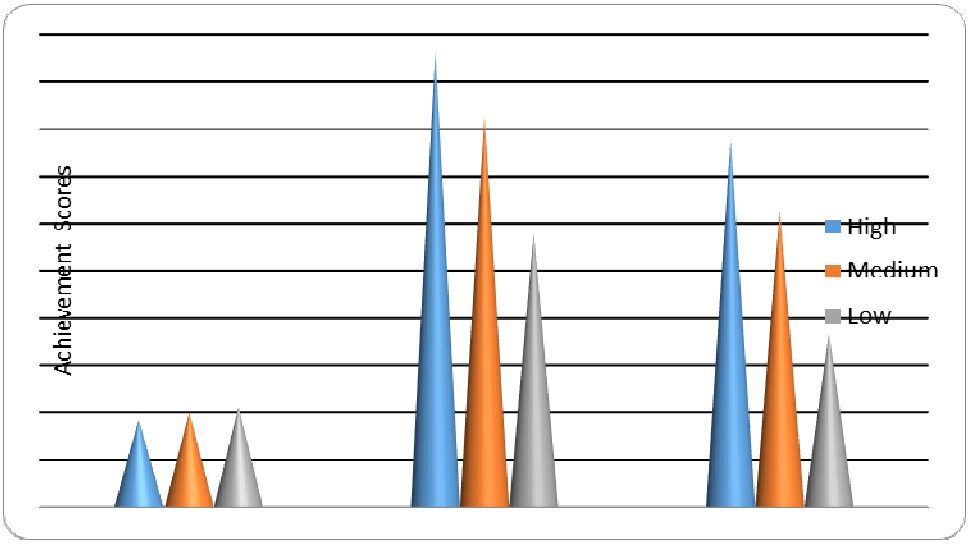

Fig. 2: Graphical illustration of high, medium and low achiever students in CSIP groups at pretest and posttest

Ho_4: There is no significant difference between students' attitude towards mathematics using CSIP and traditional teaching method. To test this hypothesis, ANCOVA was used to analyze the achievement scores. The summary of this analysis is as shown in table 7.

Table 7: ANCOVA results of students' attitude towards mathematics using CSIP and TTM

Source of Variation	Type III Sum of Squares	df	Mean Square	F – value	p – value
Corrected Model	16.091	2	8.045	45.581	0.000
Intercept	16.540	1	16.540	93.706	0.000
Covariate (Pretest)	4.792	1	4.792	27.150	0.000
Main Effect (Attitude)	12.035	1	12.035	68.183*	0.000
Residual (Error)	15.710	89	0.177		
Total	579.581	92			
Corrected Total	31.800	91			

*: Significance at 0.05 alpha level

Table 7 revealed that F (1,92) = 68.183, p = 0.000 for the main effect (Attitude) was significant. The results revealed that the computer-self interactive package (CSIP) produced a significant effect on the posts-attitude mean values of students when covariate effect (pre-attitude) was controlled. The result indicated that the treatment, using CSIP and TTM accounted for the difference in the post-attitude mean values of the students. This implies that a significant difference existed between the two groups of computer-self interactive package (CSIP) and traditional teaching method (TTM). Hence, the Hypothesis four was rejected. To show the improvement in their attitude after the treatment, the mean gain values between the pre-attitude and post-attitude mean values of the two groups (CSIP and TTM) are as shown in Table 8 and Figure 3.

Table 8: Mean gain values of students taught algebra using CSIP and TTM

Group	Pretest	Posttest	Mean Gain Value
CSIP	2.04	2.81	0.77
TTM	2.10	2.10	0.00

From Table 8, it was observed that group one had improvement in their attitude as observed in their post-attitude. For instance, CSIP had highest mean gain value of 0.77 while the (TTM) had mean gain value of 0.00. This indicates that only students in CSIP group had better attitudes towards mathematics after been exposed to CSIP and TTM as the treatment.

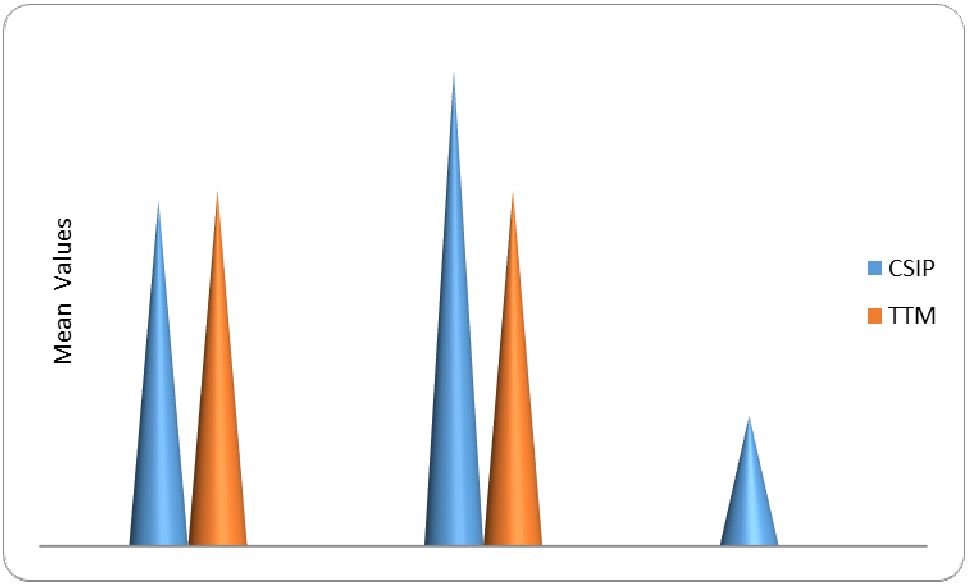

Fig. 2: Graphical illustration of students in CSIP and TTM groups at pretest and posttest

Discussion

The results of hypothesis one reveals that there is significant difference in the learning achievements in favour of the group taught Algebra concept with Computer-Self Interactive Package (CSIP). This result agrees with the findings of Gambari (2004), Gee (2008), Kirk (2003) and Manning (2004) who reported that students taught using CAI had improved performance over those exposed to conventional teaching method. It also agrees with the findings of Brothen and Wambach (2000), Butzin (2000), McSweeney (2003), Nguyen (2002), Olusi (2008), Mahmood (2006) who found that traditional instruction supplemented with computer-assisted instruction resulted in students' higher mathematical performance than traditional instruction alone. Specifically, it supported by the earlier findings of Bassoppo-Moyo (2010), Hegedus and Kaput (2004), Nicaud, Bitta, Chaachoua, Inamdar, and Maffei (2006) and Stillson and Alsup (2003) who revealed that using CAI for supplementing algebra instruction with middle and high school students had positive effects on the achievement and attitude. However, the findings contradict the findings of some few scholars who reported no significant difference in the learning outcomes of students' taught mathematics using computer-assisted instruction and those taught with traditional methods (Jacobson, 2006; Kinney, 2001; Reagan, 2004; Waycaster, 2001, Kathy (2009).

The results of hypothesis three shows that there are significant differences among high, medium and low ability students in favour of the high as against medium and lowability students taughtAlgebra concept with Computer-self interactive package (CSIP). This finding is in agreement with the results of Emeke and Adegoke (2001), Condron, (2003), Falaye (2006), Adewale (2008), Denessen, Veenman, Dobbelsteen and Vanschilt (2008), Karademir (2009), Yusuf, Gambari and Olumorin (2012) who

reported that high ability students performed better than medium and low ability students. However, it contradicts the ealier findings of Bangert-Drowns, Kullik, & Kullik (1985), Hannafin and Foshay (2008) and Mevarech and Rich (1985) who reported that CAI was more effective for lower-ability students. Furthermore, it disagree with the earlier findings of Holmes and Ahr (1994) and Muhfahroyin (2009) who found no difference between higher and lower students' ability students in the cognitive achievement of Biology and critical thinking and process skills.

The results of hypotheses four reveals that there is a significant difference in the attitude of students before and after being exposed to Algebra concepts. This result is in agreement with the findings of Chiu (2007), EklOf (2007), Hammouri (2004), Wigfield and Eccles (2002) who reported that students acquired more favorable attitude toward learning with computers than for direct instruction. Furthermore, it agrees with the findings of Bassoppo-Moyo (2010), Hegedus and Kaput (2004), and Nicaud et al (2006) who reported high levels of engagement as students interacted with software to improve algebraic reasoning.

Conclusion

The results of this study indicated that the use of computer-self interactive package increased students' performance, achievement levels and attitude towards mathematics. There was no significant difference between male and female students exposed to CSIP. The innovative technology using CAI seems to be the answer to students' poor performance, negative attitudes towards mathematics and other associated impediments in general mathematics at secondary school certificate examination (SSCE) in Nigeria.

Recommendations

Based on the findings of the study the following recommendations were made:

(i) Computer-Self Interactive Package (CSIP) should be encouraged for teaching and learning of Algebra (mathematics).

(ii) Computer should be used to arouse the interest of students towards mathematics especially in algebra.

(iii) Computer should be provided and adequately programmed with variety of computers-assisted instructional packages in Nigerian school system.

References

Achuonye, K. A. (2011). Using computer in science class: The interactive effect of gender. *Journal of African Studies and Development*, 3(7), 131-134. Available online http://www.academicjournlas.org/JASD

Adegoke, B. A. (2011). Effect of multimedia instruction on senior secondary school students' achievement in Physics**.** *European Journal of Educational Studies 3*(3), 537-541.

Adewale, J. G. (2008) Effect of brainstorming on students' achievement in junior secondary school mathematics: An effort in making school effective. *Journal of Sociology and Education in Africa 7(1*) 203 – 218.

Aluko, K. O.(2004). *Effects of cooperative learning and Individualistic instructional strategies on student's problem solving abilities in secondary school chemistry* in Illesha. Unpubished Ph.D Thesis, Department of Curriculum Studies and Educational Technology, University of Illorin, Nigeria.

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

Annetta, L., Mangrum, J., Holmes, S., Collazo, K., & Cheng, M.-T. (2009). Bridging reality to virtual reality: Investigating gender effect and student engagement on learning through video game play in an elementary school classroom. *International Journal of Science Education, 31*(8), 1091-1113.

Anyamene, A., Nwokolo, C., Anyachebelu, F. & Anemelu, V. C. (2012). Effect of computer-assisted packages on the performance of senior secondary students in mathematics in Awka, Anambra State, Nigeria. *American International Journal of Contemporary Research, 2(7), 61-65.*

Bassoppo-Moyo, T. C. (2010). Effectiveness of using computer-assisted supplementary instturction for teaching selected algebra topics at a laboratory high school. [Article]. *International Journal of Instructional Media,* 37(1),79-90.

Brothen, T., & Wambach, C. (2000). A research based approach to developing a computer-assisted course for developmental students. In J. L. Higbee and Dwinell (Eds.), *The Many Faces of Developmental Education* (pp.59-72). Warrensburg, MO: National Association for Developmental Education.

Butzin, S. M. (2000, June). *Project child: A decade of success for young children*. Retrieved November 24, 2008, from http://www.thejournal.com/articles/14835_4

Chiu, M. (2007). *Mathematics as mother/basis of science in affect: Analysis ofTIMSS 2003 data.* Paper presented at the 31 st Conference of the International Group for the Psychology of Mathematics Education.

Condron, D. J. (2003) An Early start: Effects of ability grouping on reading achievement. Retrieved online http://www.allacademic.com/meta/p/107314index.html.

Denessen, E; Veenman, S. Dobbelstean, J. & Vanschilt, J. (2008). Dyad composition effects on cognitive elaboration and students' achievement. *Journal of Experimental Education 76(4)* 363 – 383.

Eklof, K. (2007). Background indices. In I. F. Olson, M. O. Martin & 1. V. S. Mullis (Eds.), *TIMSS 2007 technical report* (pp. 281-338). Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Emeke, E. A. & Adegoke, B. A. (2001). The interaction effect of test response mode, students' numerical ability and gender on cognitive achievement in Senior Secondary School Physics. In Y. Awoska et al (eds) *Topical Issues in Education*. Paper honour of Professor C. O. Udoh. Available online at findarticles.com/p/articles/m-993765/is_200611/…/pg2

Eze, I. P (2010). Effects of two modes of advance organizers and cognitive style on students' achievement in Christian religion knowledge in secondary schools in Ebonyi State, Nigeria. Unpublished Ph.D Dissertation, University of Nigeria, Nsukka.

Faleye, F. V. (2006) Numerical ability, course of study and gender differences in students' achievement in Practical Geography. *Research in Education*. Available online at http://findarticles.com/p/articles/mi/-993765/is2006.n17194298/pg.21.

Federal Republic of Nigeria (FRN) (2013). *National policy on education*. Abuja: NERDC
.

Gambari, A.I. & Adamu, Z. E. (2008). Impact of videotape instructional package on achievement and retention in primary science among primary pupils in Niger State. *Journal of Science, Education and Technology, 1, (2), 41-48.*

Hammouri, H. (2004). Attitudinal and Motivational Variables Related to Mathematics Achievement in Jordan: Findings from the Third International Mathematics and Science Study (TIMSS). *Educational Research,* 46(3),241-257.

Hannafin, R. D., & Foshay, W. R. (2008). Computer-based instruction's (CBI) rediscovered role in K–12: An evaluation case study of one high school's use of CBI to improve pass rates on high-stakes tests. *Educational Technology Research and Development, 56*(2), 147–160.

Hegedus, S. J., & Kaput, 1. 1. (2004). *An Introduction to the profound potential of connected algebra activities: Issues of representation, engagement and pedagogy.*

Holmes, C. A. Ahr, T. J. (1994) Effects of ability grouping on academic achievement and self-concept of African-American and While students. Retrieved online at http://www.highbeam.com/doc/IGI-15630405.htm.

Jacobson, E. (2006, Spring). Computer homework effectiveness in developmental mathematics. *Journal of Developmental Education, 29*(3), 2-8.

Karademir, C. A. (2009) The effect of ability grouping classes on 7th grade students' academic achievement on the unit "if there were no pressure in science and technology education. *Eurasian Journal of Physics and Chemistry Education 1(1),* 32 – 44.

Kathy, D. S, (2009). The effectiveness of computer-assisted instruction in developmental mathematics. Unpublished Ph.D Thesis, The Faculty of the School of Education, Liberty University.

Kinney, D. P. (2001, Winter). Developmental theory: Application in a developmental mathematics program. *Journal of Developmental Education, 25*(2), 10-18, 33-34.

Kulik, J. A.; Kulik, C. C. & Bangert – Drowns, R. L. (1985) Effectiveness of computer-based education in elementary schools. *Computers in Human Behaviour* 1, 59 – 79.

Mahmood, M. K. (2005). *A Comparison of Traditional Method and Computer Assisted Instruction on Students Achievement in General Science.* Unpublished M.Ed Thesis, University of the Punjab, Lahore.

McSweeney, L. (2003, Fall). Assessing the mathematics online tool: A progress report. *Mathematics and Computer Education*. Retrieved September 28, 2008, from http://findarticles.com/p/articles/mi_qa3950/is_/ai_n9340711.

Mohammed, K. R. (2006). *The impact of computer animation learning toward Students academic performance on art and design education program.* Unpublished M. A thesis, Faculty of Education, University of Tech, Mara.

Mulifahroyin, M. (2009). *The effect of STAD and TRS integration learning strategy and academic ability toward the cognitive achievement of Biology, critical thinking and process skills of Senior High School Students in Kota metro*. Dissertasi dan Tesis Program. Pascasarjana, U. M.

Mwei, K. P., Too, K. J. and Wando, D. (2011). The effect of computer-assisted instruction on student's attitudes and achievement in matrices and transformations in secondary schools in Uasin Gishu District, Kenya. *International Journal of Curriculum and Instruction Vol. 1(1), pp. 53 – 62.* Available online at http://www.muk.ac.ke/ijci/

Nguyen, D. M. (2002). *Developing and evaluating the effects of web-based mathematics instruction and assessment on student achievement and attitude*. Ph.D Dissertation, Texas A & M University.

Nicaud,1. F., Bitta, M., Chaachoua, H., Inamdar, P., & Maffei, L. (2006). Experiments with Aplusix in four countries. *International Journal for Technology in Mathematics Education, 13(2), 79-88.*

Okafor, O. T. (2002). Teaching methods of mathematics in secondary schools. Ibadan: Special Book Ltd (Chapter 4).

Okeke, E. A. C. (2001). Women in science, technology and mathematics education in Nigeria. *Keynote address delivered at the 42nd annual conference of Science Teachers Association of Nigeria (STAN), Ilorin, Kwara State, Nigeria, 42,* 3 – 11.

Olowe, T. (2009). *Effects of computer animation and instruction model on the Performance of students in senior secondary students' biology in Minna, Niger State, Nigeria.* Unpublished Bachelor of Technology, (B, Tech) Project, Department of Science Education, Federal University of Technology, Minna, Nigeria.

Olson, V. E. (2002). Gender differences and the effects of cooperative learning in college level mathematics. *Unpublished Ph.D Thesis*, Curtin University of Technology, Perth, Western Australia.

Olusi, F. I. (2008). Using computers to solve mathematics by junior secondary school students in Edo State Nigeria. *College Student Journal, 42(3), 748-755.* Retrieved August 4 2007, from http://www.projectinnovation.biz/csj.html

Orabi, I. I. (2007). Gender differences in student academic performance and attitudes in an introductory engineering course. *American Society for Engineering Education Journal.*

Reagan, L. (2004). The effectiveness of computer-assisted instruction in developmental mathematics classes. Ph.D. Dissertation, Texas A & M University.

Reed, H. C. Drijvers, P, Kirschner, P. A. (2010). Effects of attitudes and behaviours on learning mathematics with computer tools. Computers & Education, 55(1), 1-15.

Stillson, H., & Alsup, J. (2003, Fall). Smart ALEKS…or not? Teaching basic algebra using an online interactive learning system. *Mathematics and Computer Education, 37*(3), 329-340.

Too, K. (2007). Challenges of Teaching Mathematics in Secondary Schools in Kenya: A Case study of Nandi and Uasin Gishu Districts. The Educator, 1(2) 17-26. *Journal of the school of education, Moi University.*

Umar, A. A. (2011). Effects of biology practical activities on students' process skills Acquisition in Minna Niger state. *Journal of Science, Technology, Mathematics and Education (JOSMED), 7(2).*

WAEC (West African Examination Council, 2015). *The Chief Examiners Report.* Lagos: WAEC.

Waycaster, P. (2001, June). Factors impacting success in community college developmental mathematics courses and subsequent courses. *Community College Journal of Research and Practice, 25*(5/6), 403-416.

Wigfield, A., & Eccles, J. (2002). The development of competence beliefs, expectancies or success, and achievement values from childhood through adolescence. In A. Wigfield & 1. Eccles (Eds.), *Development of achievement motivation* (pp. 92-120). New York: Academic Press.

Yusuf, A. (2004). *Effects of cooperative and competitive instructional strategies on junior secondary school students' performance in social studies, in Ilorin, Nigeria.* Unpublished Ph.D. Thesis, Curriculum Studies and Educational Technology, University of Ilorin, Nigeria

Yusuf, M. O., & Afolabi, A. O. (2010). Effects of computer assisted instruction (CAI) on secondary school students' performance in biology. *The Turkish Online Journal of Educational Technology, 9*(1), 62-69.

Yusuf, M. O., Gambari, A.I. & Olumorin, C. O. (2012). Effectiveness of Computer- Supported Cooperative Learning Strategies in Learning Physics. *International J. Soc. Sci. & Education, 2(2), 94-109.*