

Effects of Computer Assisted Instruction (CAI) on Senior Secondary School Students' Achievement in Graphics Communication and Digital Media in Oyo State, South-West, Nigeria

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ABSTRACT

The Global Systems for Telecommunication and the Information Technology (IT) industry have compelled nations of the world to adopt IT policies suitable to their needs. Thus, the Nigeria's National Policy on Information Technology (NPIT) was formulated; it recommends integration of IT tools and resources into the mainstream of education in the Nigerian schools for effective teaching and training. However, implementation of the policy requires IT product development and validation with local contents. Thus, this study developed a Computer Assisted Instruction (CAI) package as an intervention package and evaluated its effects on Senior Secondary School One (SSS1) students' achievement in graphics communication and digital media themes in Oyo Education zone of Oyo State, South-West Nigeria. The study adopted pre-test post-test control group quasi-experimental design and involved one hundred and sixty SSS1 students from four schools. One duly validated instrument named 'Students Computer Studies Achievement Test' (CSAT) $r=0.83$ was used and seven hypothesis guided the study. Findings recorded significant main effect of Computer-Assisted Instruction (CAI) on students' academic achievement in graphics communication and digital media- $[F(1,151) = 101.179, P<0.05; 2=.401]$; CAI accounted for 40% of the total observed variance in the post-test scores of students' achievement in graphics communication and digital media, while the independent variables accounted for about 60% of the variation. Findings further revealed no significant main effects of- age $[F(1,151) = .100; P>0.05; 2=.001]$ and gender- $[F(1,151)=.275; p>0.05; 2=.002]$. Conclusively, the effect of CAI package was positive on students' achievement in graphics communication and digital media and the study recommend intensive hands-on training on computer authoring software application for computer teachers and diffusion or replication of CAI package on thematic areas of computer studies by other researchers.

Keyword: Computer Assisted Instruction, Information Technology, Word Processing, Graphics Communication Software, Students' Achievement.

Aims Research Journal Reference Format:

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1. INTRODUCTION

Daily human routines and activities are constantly changing due to advances in communication technology products and services, just as application of computer tools and devices are taking over some classroom interactions in educational institutions. Teachers that are innovative in their pedagogy are also taking advantages of the relevant technology tools and resources in the course of their teaching and instruction. The use of computer in teaching and learning has become widespread among educational institutions in different countries from elementary to tertiary, because Computers have potentials to assist both teachers and students in the process of teaching and learning respectively. Thus, unprecedented changes brought about by the advent of computers and communication technologies have necessitated drastic changes in educational goals of many nations, which have led to the introduction of Computer Studies as a school subject at all levels of Nigeria's educational systems.

Globally, Computer Education curriculum for schools are not only designed to equip the learners with basic knowledge of Computer, but to develop in them required skills that could assist them to be competent in Computer education; and to enhance their self-development and continuous learning in preparations for higher education and their future career paths. Thus, the recognition given to the value of Computer in the teaching and learning processes in the modern world prompted the introduction of Computer Education into the Nigerian School curriculum about two decades ago. Therefore, to attain meaningful teaching and learning in Computer Education and dissemination of computer knowledge, the National Policy on Information Technology (NPIT) was formulated. The objectives of the policy are geared towards:

- i) integrating Information Technologies (IT) into the mainstream of education and training.
- ii) empowering the youth with Information Technologies (IT) skills and prepare them for global competitiveness.
- iii) ensuring that Information Technologies (IT) resources are available to promote efficient national development.
- iv) establishing and developing Information Technologies (IT) infrastructure and maximize its use nationwide (FRN, 2004).

According to Adamu (2004) two fundamental uses of computer systems in education have been identified which are computer as a medium of instruction and also as the subject of instruction. Ciwar (2005) also asserts that the use of computer in teaching decreases situation that could embarrass students for not finding answers to questions raised by the teacher. The author also noted that some teachers who use Computer Assisted Instruction (CAI) often implement it as supplementary instruction in form of regular assignments, meaning that children using CAI could receive additional instructions and have opportunity to practice independently. Plomp, Pelgrum and Law (2007) observed that educational institutions around the world are under increasing pressure to use the new Information and Communication Technologies (ICTs) so as to bring about changes into the classroom interactions, help students to become lifelong-learners within a context of collaborative enquiry and to help them to work and learn from experts and peers in a connected global community.

In line with the same notion, the National Teachers Institute (NTI) as an agency of the Federal Government of Nigeria (FGN) saddled with the responsibility of middle level professional training in teacher education, affirms that the old approach to teaching is teacher-centred which implies that teacher does all the talking and the learners do all the listening (NTI, 2008). In a similar argument, Adeyemi (2012) stated that the traditional or the conventional method of teaching and instruction is characterized by unspecified or vague objectives with placement of emphasis on instructor's behaviour rather than the desirable changes in students. The author further observed that under the traditional system of instruction, many of the students are motivated primarily by the fear of receiving a poor grade, losing a course credit or of being forced to drop-out of school as a result of academic failure.

However, the new technology-driven approach is learner-centred, in such a way that the learner is not rendered inactive during the learning process. According to Obiadazie (2014) Computer Education involves computer literacy, computer assisted instruction (CAI) and Computer Appreciation. The author also stressed that computer education is the effort or the ability to make citizen to become Computer Literate. It implies that the quality of education derivable in schools is largely dependent on the quality of instruction provided in the classroom by the teachers via the use of technology-driven tools and resources, which are generally termed as 'modern educational media technology'. Invariably, as a result of the need to effectively integrate Computer technology into the Nigerian educational systems at all levels of education for innovative teaching and learning; support knowledge acquisition and academic development and school information management; the Federal Republic of Nigeria (FRN) launched the National Policy on Computer Education and Literacy and attempt to ensure its full implementation from primary through secondary to tertiary education.

The objectives of the National Policy on Computer Education and Literacy at the secondary school level include:

- i. to bring about a computer literacy in each student in Nigeria;
- ii. to develop the use of computer as teaching tool in all subject areas and to familiarize students with the use of computer technology;
- iii. to enable the present generation of school children at the secondary school level appreciate the potentials of the computer and be able to utilize the computer in various aspects of life and later occupation; and
- iv. to expose the teachers and the students to the latest scientific knowledge and skills (Federal Republic of Nigeria, 2004a; 2004b; 2008; 2013).

As part of the implementation strategy for the National Policy on Computer Education and Literacy the Federal Ministry of Education (FME) also set both general and specific objectives of Computer Studies curriculum. According to Federal Ministry of Education (FME, 2009) the general objectives are to:

- i. help meet with the demand of our time and technological development;
- ii. help expose the rudiment of the computer and its workshop to the pupils;
- iii. lay a solid foundation in computer science education at the early stages of the pupils;
- iv. encourage and stimulate the interest of the pupils to computer education;
- v. paves way for easy application of computer education in other discipline;
- vi. ensures literacy in computer education at the secondary school level (Federal Ministry of Education, 2009);

While the specific objectives for teaching Computer Studies as part of the secondary school curriculum are to:

- i. develop competence in the basic skills and understanding of dealing with computer;
- ii. develop the habit of effective and direct thinking involving analytical data basic concept;
- iii. develop the habit of effective and intellectual independence with regard to computer;
- iv. develop necessary computer educational background for further education;
- vii. create a technologically based education at the secondary school level (Federal Ministry of Education, 2009);

The policy statements and the relevant documents further specified the hardware and software requirements in terms of suitable hardware options and recommended that pilot schools should be provided with eight (8) Computer systems for the effective implementation of the Computer Studies curriculum. The secondary school Computer Studies curriculum was further broken down into junior secondary school syllabus and senior secondary school syllabus. Obiadazie (2014) commended the implementation of Computer Studies curriculum in the Nigerian secondary education system as a step in the right direction, in as much that the contents has many applications especially, in mass communication, media education, science, engineering and business.

From the foregoing, the use of Computers is applicable nearly to all areas of human endeavors, just as the integration of computers in education and training cut across all levels of education i.e primary, secondary and tertiary, Computers can be used in education as a teaching tool through the use of Computer Assisted Learning (CAL), Computer Assisted Instruction (CAI), Computer-Mediated Learning (CML) and Computer Managed Instruction (CMI). Computer Assisted Instruction (CAI) which is somehow similar to CAL is generally being used in learning and instruction. According to Ekiregwo (2001) Computer Assisted Instruction is a programme of instructional materials presented by means of a computer or computer systems.

Fakomogbon (2002) also describe CAI as any instructional materials production in audio disc format or audio-visual digital disc that can be played-back through appropriate devices unto unto the available screen. Adegbija and Onasanya (2007) define Computer Assisted Instruction as the use of computer to provide instruction directly to the students by simulating teaching and learning situations. Fakomogbon, Omiola, Awoyemi and Mohammed (2014) describe the term Computer Assisted Instruction as 'the use of computers to provide instruction directly to students in order to simulate teaching and learning situations'. Clark (2008) noted that online and Computer-Mediated Learning (CML) are rooted in CAI architecture and in authoring; and that they have potential benefits to enrich learning by individuals and in group. However, Clark (2008) is concerned about how educators and policy makers might work towards realizing the potentials, especially in differentiating between potentials and misconceptions of online learning as a tool for CAI.

CAL and CAI involve the development of software that can be used as learning tools by the students. CAL or CAI works in a way that the computer would present module of instructions in sequences for the students to learn and the package would also test their mastery of the topics. With the use of CAI, the response of the learner determines the progress or otherwise of the learners which is largely dependent on the accuracy of the answers supplied by the students. CAI is applicable in the areas of lecture demonstration in the classroom, interactive teaching or offering of tutorial materials and self-testing exercise for students working individually or learning-in-pairs as well as in group-learning. With the use of self-instructional mode, CAI affords a learner to go at his or her pace with little or no input from the teachers or any form of external guidance apart from the instructions provided within the package(s).

Consequent upon this, for students to effectively use and benefit from CAI, they must be acquitted with basic computer knowledge and be skillful on how to use the keyboard, become familiar with how to give commands and instructions to the computer and must be accustomed with the use of relevant software applications (Otunla &

Akinyemi, 2014). Further, students must learn how to navigate the mouse by practicing or playing games on the computer alongside other peripherals, tools and input devices.

Further, for students to actively engage in learning using CAI, they must understand the concepts of digital learning objects/materials, CAI components and be able to combine digital information in their own minds; all these skills should enable them apply the information on CAI in a useful way, receive feedback and act on the feedbacks (Otonla, 2013)

Over the years, there have been unresolved evidences from reported studies on the potentials and impact of Computer Assisted Instruction and other related technology tools on students' learning outcomes. Thus, studies on use of CAI in teaching have presented varied outcomes, for example; Smith, Clark and Blomeyer (2005) synthesized the results of eight experimental research studies sponsored by the North Central Regional Education Laboratory (NCREL) in 2004. The authors concluded that no significant improvement was found in students' learning as a result of online learning and therefore, noted that there are many important implications for further research activities regarding online learning. Pepler and Kafai (2007) drew inferences on ethnographic research done by some authors in computer clubhouses and thereby concluded that creative design in digital media proves beneficial to young people, such that it gives them greater fluency and flexibility across platforms, provides opportunity to explore their own interests while learning new skills, and develops in them a critical eye toward digital media in the world.

Further, Englert, Zhao, Dunsmore, Collings, and Wolbers (2007) in another study examined the effectiveness of a web-based writing program with thirty-five elementary grade students from six special-education classrooms across five special-education schools; the study compared students' achievement in blended online courses with that of face-to-face classrooms. Englert, et. al (2007) reported that students in the blended online learning condition outperformed students in the face-to-face classroom conditions. Also, Di-Pietro, Ferdig, Black, and Preston (2008) reported on ascertaining whether teaching in online learning environments is different from teaching in face-to-face environments. Di-Pietro, et. al (2008) concluded that such differences actually exist and have implications for policy formulations and review of research agenda and instructional practice. Further, Means, Toyama, Murphy, Bakia and Jones (2009) synthesized a meta-analysis of forty-six experimental studies that are related to comparison of online and face-to-face classroom interactions. Means, et. al (2009) concluded that performance of groups of post-secondary students in online learning conditions on the average, are better than those groups receiving face-to-face instructions.

Light, Cerrone and Reitzes (2009) in yet another study, reported that the New York City Computer Interaction Program drastically changes the role of the teacher while engaging students by giving them more accessibility to digital technology and interactions with online learning environments. Also, Davis (2010) while reporting on a qualitative research affirms that online programmes and courses could specially fit some students with individualized learning experiences which could offer more opportunities for accessing open educational resources (OERs) and online courseware materials, more than what the face-to-face interactions within the brick-and-mortar schools could provide. The author further asserts that virtual classroom and instruction are saturated with the use of online resources such as data collection, one-to-many and one-on-one online interactions with tutors and facilitators.

Fakomogbon et.al. (2014) reported that CAI programmes that are designed using research-based teaching strategies were found to be highly effective and that students taught through CAI as supplementary to conventional approach performs significantly better than the students in the control (conventional method) group. This submission is justifiable, since students within a typical classroom have different learning styles and needs which the teacher is required to meet. More so, that students' learning styles differs and can never be the same since what motives each group of students may also be different and their level of assimilation may not be the same. Expectedly, use of CAI should take care of some of the differences among the learners. Thus, Olabiyi, Aiyelabowo and Keshinro (2013) postulated that even though computer assisted instruction (CAI) cannot solve all the learning and instructional problems, but CAI could provide teaching that is more practical, activity-based and of course interesting; and above all, CAI must be tailored towards individual student's needs.

1.1 Statement Of The Problem

The National Policy on Information Technology and the National Policy on Computer Education and Literacy as well as the Senior Secondary Schools Computer Studies Curriculum were formulated and developed by the Federal Government of Nigeria with good intentions. The ultimate goal was to develop and implement innovative technology-based learning tools and materials for teaching and learning in the Nigerian schools with the broad goal; to help students learn effectively and efficiently either individually or in groups. However, provisions and supplies of such innovative materials by relevant government agencies have not been fully implemented. In some instances where such imported tools and materials are provided, they have been found to be more of foreign contents and are thus, alien to students' cultural background and scope of experience. Therefore, to actualize and realize the laudable

National Policy on Information Technology Policy initiatives, it calls for drastic steps and actions especially among secondary school teachers, who are generally perceived to lack the requisite knowledge and skills to produce and use the recommended innovative tools and materials. Therefore, this study developed a Computer Assisted Instruction (CAI) package as an intervention device and evaluated its effects on Senior Secondary School One (SSS1) students' achievement in graphics communication and digital media themes in Oyo Education zone of Oyo State, South-West Nigeria.

1.2 Research Hypothesis

- Ho₁** There is no significant main effect of treatment (Computer Assisted Instruction) on students' achievement in graphics communication and digital media themes.
- Ho₂** There is no significant main effect of Age on students' achievement in graphics communication and digital media themes.
- Ho₃** There is no significant main effect of Gender on students' achievement in graphics communication and digital media themes.
- Ho₄** There is no significant interaction effect of computer Assisted Instruction and age on students' achievement in graphics communication and digital media themes.
- Ho₅** There is no significant interaction effect of treatment and gender on students' achievement in graphics communication and digital media themes.
- Ho₆** There is no significant interaction effect of age and gender on students' achievement in graphics communication and digital media themes.
- Ho₇** There is no significant interaction effect of treatment, age and gender on students' achievement in graphics communication and digital media themes.

2. METHODOLOGY

The study adopted pre-test, post-test control group quasi-experimental research design for the purpose of evaluating the effects of Computer Assisted Instruction (CAI) package on Senior Secondary School One (SSS1) students' achievement in graphics communication and digital media themes in Oyo Education zone of Oyo State. The Population of the study comprised all the senior secondary school one (SSS1) Computer Studies students in the Oyo educational zone of Oyo State, South-West Nigeria. Purposeful sampling technique was employed to select four co-educational senior secondary schools from Iseyin and Itesiwaju Local Government Areas which are sub-urban locations in Oyo State, where computer studies is accessible to students as a school subject and where Computer teacher, Computer equipment and accessories were available for teaching the subject. Simple random sampling was employed in selecting forty students in each of the schools totalling one hundred and sixty (160) senior secondary school one (SSS1) students' that constituted the sample for the study. The sample was thereafter classified into the experimental group and control group.

2.1 Research Instrument and the Intervention Package

The main instrument used in generating data for this study was Computer Studies Achievement Test (CSAT). Computer Studies Achievement Test (CSAT) was developed and validated by the researchers to test student's achievement in two selected topics in computer studies i.e. graphics communication applications and digital media themes. The test items consisted of forty multiple choice objective test items with (4) options i.e. A, B, C, D; per item. Students were required to pick the correct option from the options provided. Initially, a pool of 100 items was developed following the principle of test construction; the draft copy of the pool of items was revised by one Computer Studies expert and one computer programmer, each of whom were given a copy of the test draft, some of the items were substituted with new ones and some had either their stem or key modified based on their reactions. For the test validation, the pool of items was administered to forty (40) SS One Students who were not part of the sample for the study and their responses to the items were scored and analyzed. Item analysis of the instrument was also carried out to determine the validity and discrimination indices; using discriminating power and difficulty index to select the best forty items that constituted the CSAT. The final thirty items for the instrument were selected and the reliability coefficient using the split-half approach and the Kuder Richardson formula 21(KR-21) yielded a value of 0.83 which indicates a high correlation and reliability of the test instrument.

The Computer Assisted Instructional (CAI) package was also developed as the intervention package, the CAI package was trial-tested and validated for the experimental group while the Computer Assisted Instruction Guide for Computer Studies (CAIGCS) was developed for the control group. Computer Assisted Instructional (CAI) package that served as the treatment package was developed by the researchers. The content of the package focused on two themes i.e. graphics communication applications and digital media themes or topics; which were sub-divided into

sixteen lessons which included; an introduction, list of lessons, content and formative questions at the end of each topic.

The second author under the guidance of the first author developed the package using *Faststone Screencast Software* with necessary devices and accessories (including laptop computer; installed software, headset microphone e.t.c. to add audio sound clips to the visual images). *Faststone Screencast Software* was used in authoring the package, because the software allows users to easily record video and annotates learning objects on the screen including windows, images, menus, full screen, rectangular/freehand/fixed regions as well as scrolling windows or web pages.

Thereafter, Post-stage Slideshow Software was used for editing the video produced in Windows Movies Maker / Audiovisual format (AVI) to allow for ease of preview in portable devices like mobile phones, iPhones, iPad or video output setups such as; VCD/DVD movie which can be played on VCD/DVD players or DVD players. For the purpose of this study the researchers used *Photostage Slideshow Software* to convert the video to DVD data which was installed in each computer system in AVI format for the use of students in the experimental group. This was done with special considerations for the location and economic status of the students involved in the study.

The Computer Assisted Instructional Guide for Computer Studies (CAIGCS) is a manual programmed instructional (PI) package designed for the purpose of face-to-face teaching of Computer Studies to students in the classroom. The instructor's guide contains two major topics in Computer Studies i.e. graphics communication applications and digital media themes which were sub-divided into sixteen lessons. The guide consisted of a lesson plan for the entire sixteen modules of lessons and each of the lesson plan contains specifications such as: the topics with appropriate contents, the objectives to be achieved at the end of the instruction, the instructional materials and the assessment.

2.2 Procedures For Conduct Of The Treatment For The Experimental Group And No-Treatment For The Control Group

The conduct was preceded by administration of Computer Studies Achievement Test (CSAT) first as pre-test at the beginning of the procedure. Pre-test of Computer Studies Achievement Test (CSAT) was administered to the groups separately. The procedure for conduct of the treatment for the experimental group involved the arrangement of the students in the experimental group within the computer laboratory using CAI package as the only teaching strategy to facilitate students' self-learning processes within a technology-driven learning environment. The students in the experimental group were guided as appropriate on the use of the treatment package through a short introduction, guide to launching the CAI package and explorations of the CAI package.

Trained research assistants who were Computer Studies teachers in the schools were coopted to supervise students' activities in the experimental group school locations. They responded to the individual students who asked questions as regards the deployment of the CAI package in case of feedbacks and reviews. The procedure was followed by all the students in the experimental group during the six weeks of using the CAI package for self-learning on the sixteen topics. At the end of the six weeks the Computer Studies Achievement Test (CSAT) was re-administered as post-test.

In the case of the control group; conventional method was employed by the research assistants trained for the same purpose using the scripts of the Computer Assisted Instruction Guide for Computer Studies (CAIGCS). Briefings and instructions preceded the administration of Computer Studies Achievement Test (CSAT) pre-test at the beginning and followed by teaching of the sixteen topics during the six weeks. At the end of the six weeks the Computer Studies Achievement Test (CSAT) was also administered as post-test. In summary, the experimental group was exposed to Computer Studies lesson using Computer Assisted Instruction (CAI) package for the period of six weeks while the control group was also taught for six (6) weeks by trained research assistants using conventional method. Each lesson lasted for forty minutes including computer laboratory practice for the six weeks; after the CAI package treatment for the experimental group and conventional teaching with control group; post-test of CSAT was administered separately to both groups as appropriate.

The pre-test and post-test were collated with a unique identifier as appropriate for each group members and was later marked and scored. The scores obtained from two intact classes were shorted into experimental group (eighty students) and control group (eighty students). The scores were computed and used in testing the seven hypotheses. Data were analyzed using mean, standard deviation and the Analysis of Covariance (ANCOVA). The level of significance adopted for the analysis was $P < 0.05$, which formed the basis for accepting or rejecting the hypotheses.

3. RESULTS AND DISCUSSIONS

Ho₁: There is no significant main effect of treatment (Computer Assisted Instruction) on students' achievement in graphics communication and digital media themes.

Table 1: Analysis of Covariance (ANCOVA) of Post-test Mean Score of Students' Achievement in Graphics Communication and Digital Media Themes by Treatment, Age and Gender

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6944.803 ^a	8	868.100	30.883	.000	.621
Intercept	6194.426	1	6194.426	220.366	.000	.593
Pretest	219.377	1	219.377	7.804	.006	.049
Treatment	2844.113	1	2844.113	101.179	.000	.401
Age	2.811	1	2.811	.100	.752	.001
Gender	7.718	1	7.718	.275	.601	.002
Treatment * Age	17.725	1	17.725	.631	.428	.004
Treatment * Gender	4.385	1	4.385	.156	.693	.001
Age * Gender	41.410	1	41.410	1.473	.227	.010
Treatment * Age * Gender	14.517	1	14.517	.516	.473	.003
Error	4244.572	151	28.110			
Total	103830.000	160				
Corrected Total	11189.375	159				

Significant at $p < 0.05$, $R^2 = .621$ and adjusted R^2 Squared = .601

Result from Table 1 indicates that there is a significant main effect of Computer Assisted Instruction on students' achievement in in graphics communication and digital media themes - [F (1,151) = 101.179; $p < 0.05$; $\eta^2 = .401$]. The null hypothesis is therefore rejected. The partial eta squared (η^2) of .401 indicates that the Computer Assisted Instruction accounted for 40.1% of the total observed variance in the post-test scores of students' achievement in graphics communication and digital media themes. The Adjusted R^2 value .601 implies that the independent variables accounted for 60.1% of the variation in students' achievement in in graphics communication and digital media themes.

Table 2: Estimated Marginal Means and Standard Error of Treatment Group

Treatment	Mean	Std. Error
Treatment Group	30.652 ^a	.752
Control Group	17.002 ^a	1.128

Table 2 shows that the mean post-test scores of students in the experimental group is greater ($\bar{x} = 30.652$) than the mean of the control group ($\bar{x} = 17.002$). Therefore, it could be deduced that students performed better in graphics communication and digital media themes when being taught with Computer Assisted Instruction. In order to discern the source of the difference between the treatment and the control group, scheffe post-hoc comparison test was conducted, the source of significant difference, direction and amount of variation due to each treatment group were unraveled and shown in Table 3.

Table 3: Scheffe Post-Hoc Multiple Comparison of Achievement in Graphics Communication and Digital Media Themes by Treatment

Treatment (I)	Treatment (J)	Mean Difference (I-J)	Std. Error	Sig.
Computer Package Conventional	Assisted Conventional	13.650	1.357	0.000
	Computer Assisted Instruction	-13.650 [*]	1.357	0.000

Mean difference is significant at the 0.05 level.

Table 3 shows the main difference which is significant at 0.000, a value less than 0.05. It follows that the experimental group improved in their achievement in graphics communication and digital media themes after the treatment than their counterparts in the control group. It is further confirmed in the Figure 1, the profile plot which shows that the students in the experimental group performed better than those in the control group with mean scores of 30.65 and 17.00 respectively.

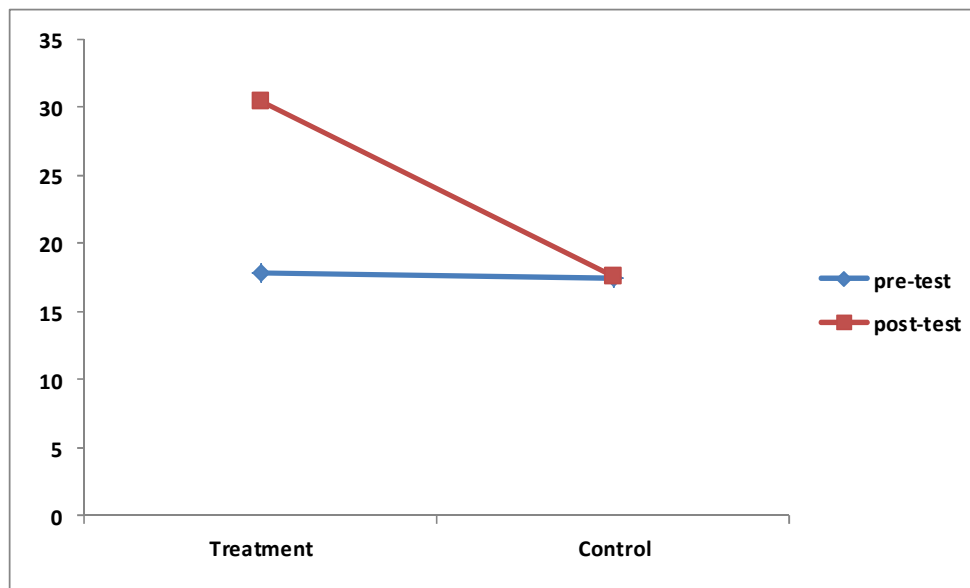


Figure 1: Pre-test Post-test Profile of Students in the Experimental Group

Ho₂: There is no significant main effect of Age on students' achievement in graphics communication and digital media themes.

The result on Table 1 indicates that there is no significant main effect of age on students' achievement in graphics communication and digital media themes [$F_{(1,151)} = .100$; $p > 0.05$; $\eta^2 = .001$]. The null hypothesis Ho₂ is therefore not rejected and the partial eta squared of .001 implies that age accounted for 0.1% of the observed variance in the post-test scores of students' achievement in graphics communication and digital media themes. The implication of this insignificance is that students do not differ in achievement in graphics communication and digital media themes based on their on their age.

Ho₃: There is no significant main effect of Gender on students' achievement in graphics communication and digital media themes.

Evidences from Table 1 further indicates that there is no significant main effect of gender on students' achievement in graphics communication and digital media themes [$F_{(1,151)} = .275$; $p > 0.05$; $\eta^2 = .002$]. The null hypothesis Ho₃ is therefore not rejected and the partial eta squared of .002 implies that, gender accounted for 0.2% of the observed variance in the post-test score of students.

Ho₄: There is no significant interaction effect of Computer Assisted Instruction and age on students' achievement in graphics communication and digital media themes.

Details as presented in Table 1 also indicates that there is no significant main effect of CAI Package and age on students' achievement in graphics communication and digital media themes [$F_{(1,151)} = .631$; $p > 0.05$; $\eta^2 = .004$]. The null hypothesis Ho₄ is rejected and the partial eta squared of 0.004 implies that combination of treatment and age accounted for 0.4% of the observed variance in the post test.

Ho₅: There is no significant interaction effect of treatment and gender on students' achievement in graphics communication and digital media themes.

Indications from Table 1 also implies that there is no significant interaction effect of treatment and Gender on students' achievement in graphics communication and digital media themes [$F_{(1,151)} = .156$; $p > 0.05$; $\eta^2 = .001$]. The null hypothesis Ho₅ is not rejected. The partial eta squared of .001 implies that, Treatment and Gender accounted for 0.1% of the observed variance in the post-test scores of students' achievement in graphics communication and digital media themes.

Ho₆: There is no significant interaction effect of age and gender on students' achievement in graphics communication and digital media themes.

The result as presented in Table 1 further indicates that there is no significant interaction effect of age and gender on students' achievement in graphics communication and digital media themes [$F_{(1,151)} = 1.473$; $p > 0.05$; $\eta^2 = .010$] The null hypothesis Ho₆ is not also rejected. The partial eta squared of .010 implies that age and gender accounted for 1% of the total observed variance in the post-test scores of students' achievement in graphics communication and digital media themes.

Ho₇: There is no significant interaction effect of treatment, age and gender on students' achievement in graphics communication and digital media themes.

The result on Table 1 indicates that there is no significant interaction effect of Treatment, age and gender on students' achievement in graphics communication and digital media themes [$F_{(1,151)} = .516$; $p > 0.05$; $\eta^2 = .003$] The partial eta squared of .003 implies that of the three fixed factors treatment, age and gender accounted for 0.3% of the total observed variance in the post-test scores of students' achievement in graphics communication and digital media themes. Hence, the null hypothesis Ho₇ is not rejected.

3.1. Discussion Of Findings

In summary, findings from this study indicated a significant main effect of Computer Assisted Instruction (CAI) on students' achievement in graphics communication and digital media themes which corroborate that of Englert, et. al (2007) who reported that students in the blended online learning condition out-performed students in the face-to-face classroom conditions. Thus, there is no gain-saying that the use of CAI package as a teaching strategy is effective over face-to-face or conventional method, just as suggested in the National Policy on Education (FRN, 2004a; 2004b). This assertion also buttressed by Davis, (2010) who affirms that online programmes and courses could specially fit some students with individualized learning experiences; Means et. al (2009) also affirms in their report on meta-analysis of forty-six experimental studies, which concluded that performance of groups of post-secondary students in online learning conditions on the average, are better than those groups receiving face-to-face instructions.

This implies that individualization of instruction through CAI explained further the higher performance recorded among the experimental group. Findings from this study are also in agreement with similar studies such as Fakomogbon et.al. (2014) which reported that the performance of students exposed to CAI packages were enhanced. The study also recorded no significant main effect of age and gender on students' achievement in graphics communication and digital media themes. This implies that age of students in experimental and control group is insignificant to their achievement. This finding agrees with Smith, Clark and Blomeyer (2005) who concluded that no significant improvement was found in students' online learning, as a result of age. Lastly, findings in this study recorded no significant main effect of gender on students' achievement in graphics communication and digital media themes which agreed with Smith, Clark and Blomeyer (2005).

3.2. Summary of Findings

The findings of the study are summarized as follows:

- Experimental group exposed to Computer Assisted Instruction (CAI) package performed better in graphics communication and digital media themes than the control group taught with the conventional method only.
- Students' age had no significant main effect on their achievement in in graphics communication and digital media themes.
- Students' gender had no significant main effect on their achievement in in graphics communication and digital media themes.
- The interaction effect of treatment and age had no significant main effect on students' achievement in graphics communication and digital media themes.

4. CONCLUSION

The study revealed that innovative instructional strategies as advocated by the National Policy on Information Technology (NPIT) if properly implemented at senior secondary school level will significantly improve students' achievement in teaching computer studies. More so, the study evidently showed that the improved performance in graphics communication and digital media themes was achieved through the use of CAI package. Therefore, Computer Assisted Instruction (CAI) package proved to be beneficiary and effective in teaching senior secondary school one students in some thematic areas of Computer Studies and more specifically; in graphics communication and digital media themes.

5. RECOMMENDATION

The study recommends as follows:

- i. Effective diffusion of CAI package and replication of the approach used in this study to develop other content areas of computer studies and possibly other school subjects.
- ii. Provision of adequate facilities for Computer Assisted Instruction (CAI) as a mode of teaching and instruction in schools for effective and conducive learning environment.
- iii. Training and re-training of teachers on ICT skills and hand-on Computer Assisted Instruction (CAI) authoring software application through seminars, workshops, conferences as well as in-service training.
- iv. Emphasizing practical teaching of Computer Studies in senior secondary schools by school heads and administrators.
- v. Monitoring of the implementation of the Nigerian IT policy and computer education and literacy policy through facility and ICT infrastructure support to schools and proper orientation for stakeholders for its full implementation.

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