PERFORMANCE EVALUATION OF COMPUTER ASSISTED INSTRUCTION (CAI) IN TEACHING AND LEARNING OF SCIENCE-RELATED SUBJECTS IN SECONDARY SCHOOL

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ABSTRACT

The objective of this research is to examine impact of computer assisted instruction (CAI) on teaching and learning of science subjects in secondary schools. It is also aimed at determining the challenges facing effective adoption and utilization of CAI in teaching and learning process. The study, which adopted survey research design approach, made use of questionnaire as research instrument, and Chi-square (X^2) to test the stated null hypotheses. The validity and reliability of the instrument were ensured at Cronbach's Alpha value (α = 0.9302). The study sample comprises 50 teachers and 250 students, randomly drawn from ten (10) secondary schools (both public and private) in Ijebu-Ode Local Government Area of Ogun State. Findings of the survey established that CAI has a significant positive impact in enhancing effective teaching and learning process, if utilized effectively. The findings of the study also established that in spite of the numerous benefits of CAI in teaching and learning process, its effective adoption in secondary schools in Nigeria is hindered by numerous challenges such as poor electricity, poor information technology (I.T) skills on the part of the teachers, and inadequate I.T. infrastructures in secondary schools in Nigeria. It is however, recommended that government should encourage the adoption of CAI through provision of necessary enabling environment and facilities. Finally, as the world is turning to a global village where technology is advancing every day, the need to technologically-inclined is the paramount goal of every organization craves for, so as to meet the challenging demands of every socio-economic and educational society.

Keywords: Evaluation, Teaching, Learning, Information and Communication Technology, Instruction.

1.0 INTRODUCTION

Man is specie of the kingdom *'Animalia'*, specifically and wonderfully created to employ Mathematical concepts in understanding the world around him. There is hardly any human being, whether literate or non-literate, who does not apply science concepts in everyday life, even though he may not be aware of it. All over the world, people who are exposed to formal education are taught science during the process of their schooling because these are unique subjects that plays prominent roles in the school curriculum.

The three educational objectives of Nigeria clearly stated in Article 18 of the 1999 Constitution of the Federal republic of Nigeria, emphasize:

i. Equal and adequate educational opportunity for all,

ii. Promotion of science and technology

iii. Eradication of illiteracy through provision of free education for all.

Of all these three objectives, the one that is most relevant to science, education is the second objective that deals with the promotion of science and technology. Nigeria aspires to be a modern, industrial and developing society desiring this attribute in order to acquire the knowledge in science-oriented and innovative. It is obvious that this can only be achieved with a proper and solid foundation in science knowledge.

Many of the scientists like Archimedes and Gallileo who came up with striking innovations in science were exposed to the best scientist's educationist in their days. The National Policy on Education spells out in details the modalities for achieving the National educational objectives. The policy identifies three tiers of educational system, namely: primary, secondary and tertiary.

The democratic government of President Olusegun Obasanjo in September 1999 inaugurated the Universal Basic Education (UBE) scheme shortly, after democracy was reinstated in Nigeria. The scheme covers pre-school education, the primary education (6 years) and the junior secondary school education (3 years).This scheme involves compulsory basic education for all Nigerian children up to the JSS level. The important role that mathematics plays in achieving the objectives of the UBE has made it to be a compulsory subject in the UBE scheme.

The way in which children think about sciences and the process they use to solve problems must be understood and taken into account by the teachers and curriculum planners who design instruction. It is a great mistake to suppose that a child acquires the skill of sciences concepts just from teaching. Children construct their own knowledge and do not simply accept the teacher's version. Although teaching clearly affects what the students learn, it does not determine it. Teachers must be aware of how children think about sciences and they should build instruction on children's existing knowledge and the problem-solving strategies they have already developed.

This gives children room for experimenting and solving of science's problems on their own. Children learn more through activities and through discovery techniques. Hence, emphasis should be on children engaging in physical activities with materials, real-life objects or models, games playing and the use and application of real-life situation. The success of any classroom discussion depends on the effective handling of the concept by the teacher; which is also depends on the personal characteristics of the teacher, his willingness to provide and use materials and organize relevant science activities for the students. The teacher himself must have positive attitudes to science concepts and understand that his primary concern is the development of positive attitude of his students during the study of sciences. Positive attitude is a dynamic force to the study of any subject.

To overcome the problem of teaching and learning of sciences, this study is set out to determine the performance evaluation of computer-assisted instruction in the teaching and learning of science-related subject in secondary schools. Ayeni (1990) defines computer as a data processing machine that can store and process data based on the logic supplied by the user. There are many ways in which the computer is used in education which include: Computer Supported Learning (CSL), Computer Supported Learning Aids (CSLA), Computer Based Education (CBE) and Computer-Assisted Instruction (CAI) etc. However the methods that is most directly related to instruction is the Computer-Assisted Instruction (CAI) which is an automated instruction technique in which computer is used to present an instructional programmes to the learners through an interactive process. CAI is designed and presented in a way to gain the attention of the learner from the beginning of the learning process to the end. It does this by providing new avenues for drill and practice. CAI can provide the educational needs of both able and disable learners. It is therefore, believed that CAI holds great promises for education. Its only limitation can be human being of limited knowledge and tendency to resist change; lack of enough funds; shortage of materials in terms of software, hardware and infrastructural facilities.

CAI has characteristics that help to improve learning. These include learners controlled instruction, feedback possibilities to the learners, self-pacing and lessons with more than one purpose, and help students to learn at their rate. Computer system is divided into instructional modes for effective way of organizing learning experiences. These modes have been presented by Ajelabi (2000), to include the following: drill and practice, game, simulation, information, modeling, problem analysis. Therefore, the teacher needs an organized course to alleviate fears, frustration and feeling of self-insufficiency. Computer literary play this key role in the reforms of teaching/learning situation in the classroom. The purpose of this study therefore, is to determine the performance of the use of Computer-Assisted Instruction (CAI) on the teaching and learning of science-related subjects in secondary schools.

2.0 STATEMENT OF THE PROBLEM

In the past, failure in science subjects has prevented many children from furthering their education and thus made them ended up in not being skilled enough to be trained as professional. Most of the time children get frustrated when they are unable to progress in solving a problem in science subjects and developed apathy and hatred for the subject which has adverse effect on their academic progress.

It has been observed that many students at JSS level have lost hopes about ever understanding or passing science subject and this is mostly responsible for the increase in social vices such as examination malpractices, cultism amongst others. The problem of teaching and learning science in Nigeria secondary Schools did not just surface overnight. It is a result of cumulative problems starting with our government, schools, curriculum, parents, students, teachers and society.

The generality of Nigerians, even the educated ones are not computer literate owing to the fact that they are not exposed to computer education at their elementary level of their education. This has contributed to a poor state of information technology in Nigeria. With the introduction of computer-Assisted Instruction in secondary schools, a lot of improvement will be achieved to adequately prepare students and teachers to address the problems and make students develop interest in science subject**.** The study will therefore, attempt to address the following research questions:

i. What is the status of computer education in Nigerian secondary schools educational development?

ii. What is the extent at which developing Vocational education through computer literacy has been inculcated into Nigerian secondary school curriculum?

iii. What are the achievements of Nigeria National Computer Policy Objectives in Nigerian secondary schools?

iv. What are the educational benefits of computer-Assisted Instruction in teaching and learning of science's as related subjects?

iv. In what ways do the quality of instruction produced through CAI leads to more positive attitude towards learning of sciences as related subjects than the conventional instructional techniques?

2.1 RESEARCH HYPOTHESIS

In a bid to answer the research questions above, this study will also seek to analyze the null hypotheses stated below:

H_{O1}: Computer-Assisted Instruction does not have any significantly positive impact on teaching
and learning of sciences

H_{O2}: There is no significant difference between CAI and the conventional teaching techniques

3.0 LITERATURE REVIEW

3.1 STATUS OF COMPUTER EDUCATION IN NIGERIAN SECONDARY SCHOOLS

In the 1960's and early 1970's *"teaching aids"* were used to facilitate teaching. They were restricted to non-projected, non-mechanized materials such as blackboards, maps, cardboard materials and real objects. However, from the late 70's till date, projected hardware and software, non-projected aural and visual as well as new methods of instruction had been introduced.

Presently, the world is in the age of technological development and growth in information and communication technology (ICT) is the order of the day. Computers are at the learnt of this revolution because they are very fast information processing machine (Hawkridge et al. 1990). The first National Conference on Computer Applications in Nigeria was held in February 1985 at the University of Lagos. The conference did not address the issue of computer education in Nigeria. The first remarkable and commendable achievement towards actualizing and consolidating computer education could be traced to 14th December, 1987 when the then Honorable Minister of Education, Professor Jubril Aminu inaugurated a National Policy on Computer Education Committee headed by Alhaji Hafiz Wali. The major reason was to enable Nigeria catch-up with the rest of the world and be ready to enter into the 21st century development on the same footing, with them (Gbobaniyi, 1991). The functions of this committee include *'planning for a dynamic policy on computer education and literacy in Nigeria as well as devising clear strategies and terminologies to be used by the Federal and State governments in introducing computer education'*. The general objectives of the policy include:

i. To bring about a computer literate society in Nigeria by the mid-1990's

ii. To enable present school children to appreciate and use the computer in various aspects of life and future employment

On the 14th September, 1988 Alhaji Hafiz Wali who was the chairman of the committee presented the report to the Minister. A curriculum guide was developed and the report was appraised by the National Council on Education (NCE) in 1990 (Gbobaniyi, 1991). This led to the Federal Government College (Unity Schools) which were all equipped with micro-computers. The schools were used as pilot study for computer appreciation and conducted for the head of these institutions at the Federal Universities of Technology Minna in October, 1988. Intensive course were conducted for one hundred and ninety seven teachers from their institutions to be used as pilot schools. It was hoped that the teaching of the subject started immediately the equipment were ready. Prior to this time, computer education has been limited to few of the tertiary institutions and some companies in the country (Warner and Meehan, 2001). It was also hoped that, with time the pilot program started with the Federal Government Colleges, computer education will spread to all other secondary schools in the country. However, this ideal has not materialized; computer education is still limited to the pilot schools, tertiary institutions, some companies and private schools. Almost all the schools where computer education exists do not have enough facilities for effective implementation of the programme. Computer education is still at a very low level in the country. This state may lead to bankruptcy in the Nigerian child when compared with her counterpart in other countries of the world. To date computer education has been introduced as an examinable subject at the JSS and SSCE level despite its introduction for over a decade into Nigerian Secondary Schools.

3.2 EXTENT AT WHICH DEVELOPING VOCATIONAL EDUCATION THROUGH COMPUTER LITERACY HAS BEEN INCULCATED INTO NIGERIA SECONDARY SCHOOLS CURRICULUM

A developing nation needs efficient services of technicians, engineers and technologist who have received formal training from vocational technical institutions. Akanbi (1994) notes that, in businesses most customer service records are stored by computers. Many vocational and technical enterprises in developed nations like the United States, Britain, Germany, France and others now employ the use of computer packages and software. In order to work in an industrialized nation, vocational and technical education professionals clearly need to be computer literate.

Vocational education is regarded as education which provides the recipients with the basic knowledge and practical skills needed for entry into the workforce. Vocational education as part of a general education programme essentially constitutes any form of education with the primary purpose of preparing people for useful employment in a recognized occupation (Oswald, 1996; Packard et al., 1993). Perney and Ravid (1990) describe vocational education as that type of education which is concerned with the development of skills, knowledge and attitudes necessary for success in any occupation. Vocational education includes technical education that provides both practical and theoretical instruction (Oni, 2000). Such instruction is usually given to those who need employment in commerce and industry or any type of enterprise which involves the used tools and other machinery.

Aderemi (1997) explains vocational education as that aspect of the total education process that focuses on Individual occupation. Being computer literate suggests the ability to use several specific applications (e.g., Microsoft word, Microsoft Internet explorer, and Microsoft outlook) for certain very well-defined simple tasks. However, real problems can arise when such a computer literate person encounters a new program for the first time. Ideally, a computer literate person has the knowledge and ability to use computers and

technology efficiently. He can demonstrates the ability to use technology to access, manipulate, evaluate, use and present information; he or she is also comfortable using computer programs and other applications for professionals and personal purposes. Computer literacy also requires a conceptual understating of system analysis and design, application programming, system programming and data centre operations.

If vocational education in Nigeria Junior Secondary Schools is integrated into content areas, integration practices will need to be taught in teacher education programmes. The challenges for teacher education programme is determining what computer training is needed for prospective teachers. Teacher education programme fall into two categories.

The first category constitutes current teachers who lack the computer skills to integrate technology into course content. The other category concerns the pre-service teachers presently undergoing training in various colleges of education in Nigeria. The content of computer training should be the same procedure for prospective teachers. Computer integration can be taught in the different Vocational education subject areas. Computer training could emphasize hands-on experience and application of computers to classroom situations. Gain (1990) enumerated what should be included in the content of computer training for teachers to include:

i. The administrative use of the computers for class management
ii. The integration of compute assisted instruction (CAI)
iii. The use of utility packages
iv. The selection and evaluation of course ware and
v. The design and authoring of course ware.

The junior secondary school in Nigeria is both pre-vocational and academic. The pre-vocational electives according to Nigerian National Policy on Education (2004) include agriculture, business studies, home economics, local crafts and computers. Thus, computer education should take the form of vocational specialization (i.e. teaching computer as a discrete subject and also a permeated approach that is, introducing and integrating some components of computer studies into subjects such as local crafts, home economics, business studies and agriculture. Some other possibilities for implementing computer education in vocational programmes emerge. For example, computer programming languages at the secondary school level should ideally include Logo and BASIC while computer components in agriculture should employ some measure of Geographic Information System (GIS). Similarly, Computer-Aided Design (CAD) can be used to teach product design principle such as size and proportion, while Computer Aided Manufacture (CAM) as well as Computer-Integrated Manufacture (CIM) can be taught in upper secondary classes with utility software which can be integrated into a variety of businesses. Clearly computer education is vital to the development of array of vocational subjects.

3.3 EDUCATIONAL BENEFITS OF COMPUTER-ASSISTED INSTRUCTION ON STUDENTS LEARNING OUTCOMES

The benefits of Computer-Assisted Instruction on students learning outcomes are summarized thus:

i. The use of CAI as a supplement to conventional instruction produces higher achievement than the use of conventional instruction only.
ii. The use of CAI and other computer applications produces higher achievement than conventional instruction.
iii. Students learn material faster with CAI than conventional instruction.

iv. The use of CAI lead to more positive attitude toward computers, course content, quality of instruction, and school in general than the use of conventional instruction only.

Edwards et al., (1995) explained that the use of word processor in writing programs leads to better writing activities and writing outcomes than the use of paper-and-pencil or conventional typewriters. Specific positive outcomes associated with the use of word processors in writing include: longer writing samples, greater variety of word usage, more accurate mechanics and spelling, more substantial revision greater responsiveness to teacher and peer feedback, better attitudes toward writing, freedom from the problem of illegible handwriting (Bialo and Siving, 1990). Students learning rate is faster with CAI than with conventional instruction. In some cases, the students learned the same amount of material in less time than the traditionally instructed students.

The retention of content learned using CAI is superior to retention following traditional instruction. Kinnaman (1990) founds that CAI students have more of an internal locus of control sense of self-efficiency than conventionally instructed students. CAI students have high rates of time-on-task than traditionally instructed (Bialo and Siving 1990).

3.4 QUALITY OF INSTRUCTION PRODUCED BY CAI AND CONVENTIONAL INSTRUCTION: COMPARATIVE ANALYSIS

Proper individualization of instruction is enhanced when a student can control his or her learning in terms of choice of materials and in accordance with his intellectual ability. Individualized instruction is learner-paced (self-paced) rather than teacher-paced (forced-paced) exhibited by conventional instruction. Feeder possibilities to the learner are one of the most impressive characteristics of the assistance which the computer renders to the learners. Immediate feedback is used during the active learning process to inform the learner whether response is elicited. Delayed feedback is often used in testing situations which answers are given on completion of test, whereas it is only the delayed feedback that is possible in conventional instruction.

Adaptability of instruction, stresses the presentation of materials as opposed to contents is a common characteristic of CAI. The methods of instruction can be modified or changed to meet the needs, abilities or interest of the learners. A single lesson may provide several paths from which students may choose certain path, whether fast or slow. This is a form of adaptability of CAI.

The CAI is a form of individualize mode of learning. By this, the learner goes through the learning activities according to his own speed and ability. Each learner is allowed as much time as he needs to respond to the stimuli presented by the computer. The response latency of each leaner may be analyzed by the instructor to determine the difficulty level of the different segment or to isolate the particular weak students. The more responses are delayed or prolonged the more it costs to run a CAI system as this is a major setback when compared to conventional instruction.

3.5 ATTITUDE OF STUDENTS TOWARD COMPUTER-ASSISTED INSTRUCTION (CAI)

Looper (2006) defined the attitude as *'a mental position relative to a way of thinking or being'*. According to Ruffin (2000), students' positive attitude toward CAI plays a key role for the success of CAI implementation. Most of the researchers were concentrated on the

attitude toward computers as a demographic variable in the CAI related studies. For example, Kulik and Kulik (1991) conducted a meta-analysis study to investigate the relation between computer-based instruction (CBI) and traditional instructional mode based on learners' achievement and attitudes. Results showed that CBI usually produced positive effects on learners of all ages, from children to adults. The authors also posit that CBI produced small but positive changes in student attitudes toward teaching and computers.

In his dissertation study Bush (1991) hypothesized that *'students utilizing CAI will have a significantly higher positive attitude-toward computer than non-computer users'* and the statistical analysis resulted in no significant difference between the groups contrary to literatures suggesting that attitudes towards computers will improve if subjects have inculcated computer-assisted instruction as a form of teaching. Szabo and Poohkay (1996) investigated the effects of animation in a geometry lesson. The study investigated the students' attitudes towards the CBI. Three groups of students participated in the study: text-only group, text with static graphics group and texts with animated graphics group. The animation group outperformed both of the other group on the post-test scores. However, attitudes toward CBI were higher for groups with illustrations (last two groups) when compared to the text only format (Sundruck, 2003). Ruffin (2000) investigated the relationship between demographic variables and student attitudes toward computer-aided instruction. Attitude toward computers, average daily exposure to computers and computer-literacy courses are the significant variables that influence the attitude toward CAI.

Another study which was conducted by Vale (2001) support Ruffin's position, results of which indicated that the length of time using computer in mathematics and the nature of the learning environment are two factors that influence the students' attitude toward computer-based mathematics. Furthermore, analysis of the study revealed that females who rate themselves high 'achievement' in computing are more likely to have a positive attitude towards computer-based mathematics although the overall results showed that females perceived the CBL environment less favorably than males.

3.6 CAI AND RETENTION LEVEL

It has been established that, duration of active learning, distributed practice of academic content has influenced the level of academic retention (Belfiore, Skinner and Ferkins, 1995). The level of retention of mathematical knowledge also depends on the type of teaching method. Instructional methods that allow students to participate actively in learning process are the only significant variable which has an impact on the long-term retention. Lecture method continues to be the most prevalent teaching mode in secondary and higher institution of learning; despite overwhelming evidence that it produces the lowest degree of retention for most learners. According to *'Dale's Cone of Experiences',* the highest retention rates are devoted to discussion, practicing by doing, and teach others with the respective percentages 50%, 75% and 90% (Lalley and Miller, 2006). In one of the earliest study, Spies (1997) stated that only three research studies among thirty-three investigated the retention level as a research variable in the context of computer-assisted instruction (CAI) and found that traditional is superior to CAI.

Cartnal (1999) compared two different teaching methods based on retention rate and his results indicated that no significant difference in students' retention mean scores for traditional and computer-assisted mathematics course. A study by Tawfik (2005) supports these findings that there were no significant difference between methods of instruction (tradition instruction and CAI) in terms of retention level. Contrary to the above results, Brenluin (1992) conducted a study to examine the effects of computer-aided instruction on

the understanding and retention of polygonal areas concepts in high-school geometry. The results of the study indicated that the rate of retention decay was significantly slower for the experimental group on all ability levels (remedial, average, and accelerated). Further statistical analysis revealed that the experimental group possessed higher overall retention scores. Similarly, Speis (1997) indicated that the generative approach with CAI is much more effective on the student's retention of multiplication facts over long term.

4.0 RESEARCH METHODOLOGY

This study is set out to determine the performance of the use of Computer Assisted Instruction (CAI) on the teaching and learning of science subjects. This research was carried out using descriptive survey design approach, which involves the use of questionnaires to elicit responses from the target audience with the view of analyzing and describing in a systematic way, facts about the use of CAI on teaching and learning of science-related subjects. Our study area is Ijebu-Ode Local Government Area of Ogun State, Nigeria. The questionnaire, which was constructed on five-point Likert's scale, contains twenty-five (25) items which provides alternative answers to the research questions. To ensure validity of the items on the research instrument, a copy of the questionnaire was given to an expert in measurement and evaluation in the Department of Educational Management, TASUED for validation based on their expertise and experiences in the construction and use of similar instruments for collecting necessary data and information. Reliability of the instruments was ensured at *Cronbach's alpha coefficient* value of 0.9302 implying that the instrument was suitable for the study.

4.1 POPULATION, SAMPLES AND SAMPLING TECHNIQUE

All the secondary school students and teachers in Ijebu-Ode Local Education District Area of Ogun State constituted the population for the study. Due to constraints such as cost, time and mobility factors, only ten (10) schools (both public and private) were randomly selected for the study. These include: Adeola Odutola College; Ijebu-Ode Grammar School; Ijebu-Ode Muslim College; Our Lady of Apostles; Anglican Girls Grammar School; Al-Faoz Model School; Moslem Comprehensive High School; Christ Church Private School; Ansar-u-Deen High School; and Governor's Academy Ijebu-Ode. A total of 300 science students and teachers were randomly selected for the study comprises of 250 students (25 from each schools) and 50 teachers (5 from each school) respectively. The instruments for data collection were administered with the help of research assistants.

4.2 DATA ANALYSIS AND RESULTS

Descriptive and inferential statistics were used for the analysis of the data obtained. Frequency and cumulative percentage were used to analyze demographic information presented in Table 1 while Chi-Square (x^2) was used to analyze the null hypotheses stated in section 2.1.

Table 1: Demographic information of respondents used in the study

	Frequency	**Valid Percentage (%)**	**Cumulative Percentage (%)**

Respondents Distribution by Sex Gender			
Male	132	44.0	44.0
Female	168	56.0	100.0
Total	**300**	**100.0**	
Respondents Distribution by status			
Teachers	50	16.7	16.7
Students	250	83.3	100.0
Total	**300**	**100.0**	
Respondents Distribution by Age			
Below 16yrs	172	57.3	57.3
16 – 18yrs	63	21.0	78.3
Above 18yrs	65	21.7	100.0
Total	**300**	**100.0**	

Source: Field survey (March, 2016)

From the above table, it was gathered that 132 (44%) of the respondents were males, while 168 (56%) were females. This shows that more female respondents participated more in the study than their male counterparts. However, this does not have any negative effect on the study. As established earlier, 50 teachers (16.7%) and 250 students (83.3%) participated in the study. The age distribution of the respondents showed that 235 (78.3%) of the total samples are 18 years of age and below while 65 (21.7%) of the samples are above 18 years of age. It is worthy to state that the latter comprises the fifty teachers sampled and fifteen students (age bracket 19-22 years) distributed across the selected school.

Table 2 and 3 showed the results from the analysis of null hypotheses stated in the previous section with their respective decisions.

*Table 2: Results from the Analysis of Null Hypothesis (**Ho_1**)*

Responses	Observed N	Expected N	Residual	df	X^2 Calculated value	X^2- Critical value	P	Decision
Strongly Agree	70	75	0.33					
Agree	120	75	27.0	3	54.66	7.815	0.05	Reject the null hypothesis
Disagree	80	75	0.33					
Strongly Disagree	30	75	27.0					
Total	300							

Source: Field survey (March, 2016)

*Table 3: Results from the Analysis of Null Hypothesis (**Ho_2**)*

Responses	Observed N	Expected N	Residual	df	X^2- Calculated value	X^2- Critical value	P	Decision
Strongly Agree	70	75	1.33					
Agree	120	75	12.0	3	24.68	7.815	0.05	Reject the null hypothesis
Disagree	80	75	3.0					
Strongly Disagree	30	75	8.33					
Total	300							

Source: Field survey (March, 2016)

From Table 2, it can be observed the X^2-calculated value (54.66)>X^2-critical value (7.815) at (P=0.05) significant level. Therefore, the null hypothesis (**Ho_1**) was rejected; implying that computer assisted instruction (CAI) has significant positive impact on teaching and learning of science-related subject in secondary schools. Also, in Table 3, the X^2-calculated value (24.68) > X^2-critical value (7.815) at (P = 0.05) significant level, leading to the rejection of null hypothesis (**Ho_2**). This implies that there is a significant difference between Computer Assisted Instruction (CAI) and conventional teaching techniques.

5.1 DISCUSSION OF FINDINGS

The study was conducted in other to evaluate the performance of Computer Assisted Instruction (CAI) on teaching and learning of science-subjects in senior secondary schools. It is also aimed at determining the challenges facing the effective adoption and utilization of CAI in teaching and learning in Nigerian secondary schools. The general introductory aspect shed lights on the benefits of CAI on teaching and learning. Many literatures, theoretical frameworks, empirical reviews were extensively discussed in this research. In carrying out this research, researchers conducted a survey on the ten selected senior secondary schools in Ijebu-Ode local government area of Ogun state. The study made use of a structured questionnaire as research instrument. A total number of 300 questionnaires were distributed to the respondents, out of which fifty (50) were administered to selected teachers across the ten schools, while the remaining two hundred and fifty (250) questionnaires were administered to students randomly selected from these schools.

Two null hypotheses were formulated and tested using Chi-Square (***X^2***) statistical tool. The results of the analysis showed that the use of CAI has a significant positive impact on students' retention ability and learning outcomes. Also the findings established that CAI foster effective instruction delivery and efficient learning outcomes than the conventional methods of instruction. This is visible from the rejection of null hypothesis (**Ho_1**) which

states that 'there computer assisted instruction does not have any significant positive impact on teaching and learning of science-related subjects'. This justifies earlier studies such as Ruffin (2000), Vale (2001), and Spies (1997) to mention just a few. In similar manner, the null hypothesis (**H_{O2}**) was also rejected as the results showed that there is a strong significant difference between the use of CAI for teaching science-related subjects and conventional methods currently been used in our secondary schools. This supports the view of Sundruck (2003) and Kulik and Kulik (1991).

Evidences emanated from the reviewed works revealed that, despite of the benefits of computer education and CAI in teaching and learning, its effective adoption in Nigerian secondary schools has been hindered by numerous challenges such as inadequate computer skills of the teacher to integrate computer into subject content, poor ICT-based pedagogical facilities, and above all, epileptic power supply. From the analysis, we can conclude that the use of Computer Assisted Instruction (CAI) in teaching and learning is still in an embryonic stage in Nigerian secondary schools system.

From the findings of this research, the following implications are germane:

i. Computer assisted instructions has a significant positive impact in enhancing effective teaching and learning process.

ii. Computer assisted instructions captures student's attention towards learning and also promotes student retention level and performance than the conventional method of instruction.

iii. Poor I.T. skills by teacher on the usage of CAI into course content, and poor ICT infrastructure is one of the major factors hindering effective utilization CAI in teaching and learning process.

iv. Electricity poses great challenges to effective utilization of CAI into course content.

6 CONCLUSION, RECOMMENDATION AND SUGGESTION FOR FURTHER RESEARCH

The analysis and discussion for the data collected in the study make it obvious that despite the usefulness and effectiveness of ICT learning tools such as CAI in teaching and learning process, its application is still faced with series of challenges such as inadequate ICT facilities in schools, inadequate skilled personnel, cost of procurement of this gadget and poor utilization of this gadget by teachers during teaching/learning process. Consequently, the adoption of CAI has remained in an embryonic stage till date. Hence, for the potentials and benefit of ICT to be fully explored and enjoyed by both students and teachers, for supplementing learning and teaching, all stakeholders in education should be involved in making sure that adequate ICT facilities such as computer assisted instruction (CAI) are provided for the educational system. This will, in no small measure, assist the students whose present learning experience is to be changed for better and also the teachers that will later become the knowledge engineers. Based on literatures and the findings of this research, the following recommendations are made:

i. Government should support, facilitate and encourage the use of ICT pedagogical gadgets such as CAI in secondary schools by providing adequate ICT tools in schools for teaching and learning process.

ii. ICT orientation programmes should be organized for teachers so as to expose them to effective adoption CAI into course content and in classroom instruction planning.

iii. Government should put in place measures to combat the epileptic power supply in Nigeria so as to encourage effective ICT adoption in schools

Future research should focus on the effect of computer assisted instruction on students academic achievements with larger samples size. More so, future researches should utilize this research work as literatures upon which further investigation should be made.

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