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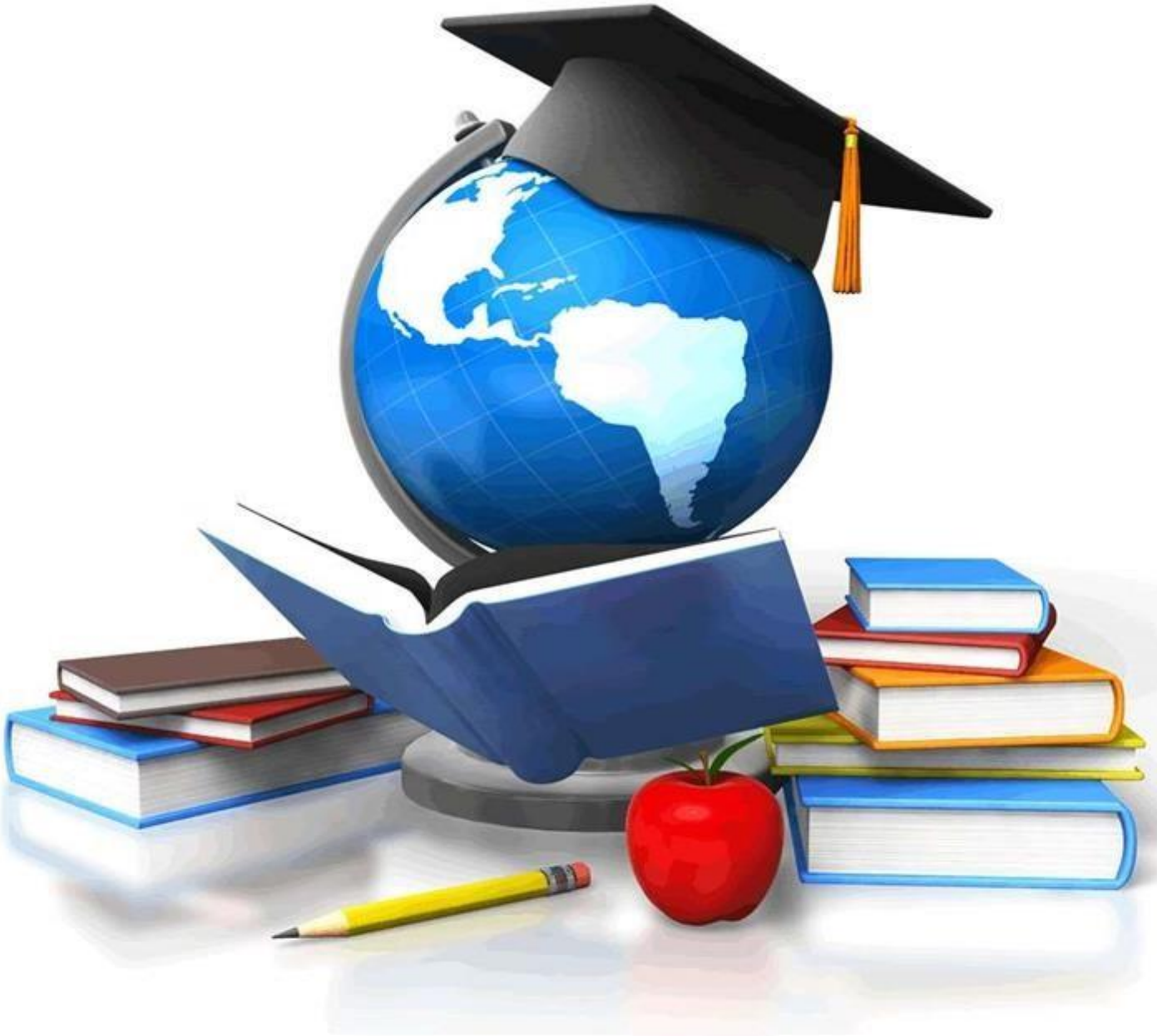

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Effect of Computer Assisted Instructional (Cai) Package on Senior Secondary School Students' Achievement in Mathematics: A Post- Covid Sustainable Development in Nigeria.

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Abstract

Purpose: This study investigated the effects of Computer Assisted Instructional (CAI) Package on senior secondary school students' achievement in Mathematics: A post-Covid Sustainable Development in Nigeria.

Methodology: The research design adopted was quasi-experimental research design. The sampling technique was multi stage sampling techniques. One hundred and seventy-eight (178) SS2 students comprising 90 male and 88 female students served as sample size. The research instrument was Mathematics Achievement Test (MAT). The reliability of the test instrument was determined using the Pearson product moment correlation analysis formula. A correlation coefficient of 0.86 was obtained which was considered high and suitable for gathering data. The instrument was certified to have face and content validity by expert opinion. Descriptive statistic such as Mean and Standard deviation were used to answer research questions, while t-test was used to test hypotheses at 0.05 significant levels.

Findings: The findings among others revealed that students taught mathematics using Computer Assisted Instructional (CAI) Package achieved more than that taught mathematics using the conventional method of teaching.

Unique contribution to theory, policy and practice: This study recommended that the use of CAI enhances Achievement of Students in Mathematics especially during post COVID era; therefore, teachers should be discouraged from the use of conventional method of teaching Mathematics but rather to embrace teaching Mathematics using Computer Assisted Instructional (CAI) package on Senior Secondary School Students' Achievement in Mathematics and Post-COVID Sustainable Development in Nigeria.

Keywords: *Mathematics, Computer Assisted Instructional (CAI) Package, Achievement, Post-Covid, Sustainable Development.*

INTRODUCTION

Mathematics is viewed as continuous activities without limitations, and can be described as a body of knowledge that is as old as man himself. The subject does not only prepare man for life, but it involves life itself. It is indispensible in all human endeavours. This is why much attention is given to it in the school curriculum. Mathematics is a tool for scientific and technological advancement (Bolaji, 2008).

Mathematics has contributed more to the objectives of the general education of man than any other subject. It is for this reason that almost all nations of the world make the study of Mathematics compulsory both in primary and secondary school levels of education. Mathematics is a way of thinking; this implies that, Mathematics affects every area of human life. For example, in buying and selling, simple arithmetic is needed; construction of bridges, roads and houses, geometry is involved; in cooking, measurement and estimation is needed (Lassa, 2012). Furthermore, farmers need number bases and simple counting techniques to enable them know the numbers of products they have in their farms.

To equate balance and relationship, algebraic and simple equation is involved, this has helped both family and the society in general to resolve issues that can generate conflict, like political sharing of leadership and revenue generation in the society; algebraic expression using inequality is applied. For instance, what is done for A must be done for B; this will eventually help to minimize marginalization in all regions of the country and so on.

Nigeria, like most African countries, reposes implicit confidence in the power of science, technology and Mathematics to salvage her from the ravages of poverty, ignorance, diseases and enhanced Sustainable Development. These three indices mostly defined the event of her underdevelopment. Therefore, science and technology work hand in hand with Mathematics and Mathematics is also the language of science and technology. Mathematics is described and seen as the queen of all science and technology (Odili, 2006). Azuka (2006) stipulated that Mathematics is the foundation of all sciences, technology and modern development. He also opined that for any nation to survive and develop, that nation has to improve on its technology which could only be achieved through effective teaching and learning with the help of computer and other instructional materials.

Dantala (2005) defined Computer as an electronic machine that is capable of solving problems by manipulating data, accepting data, performing operations on the data and supplying the results of these operations as information. Computer has made knowledge the most prized commodity. It has been found useful in engineering, banking sector, medicine, communication, commerce, security and industries. Gimba (2006) stated that computers can be use in the classroom as a medium of instruction for achieving effective teaching and learning in Mathematics. Parveen (2003) stated that the use of computer could transform educational system, prepare students for the informational

age and speed up national development especially on this period of post-Covid era for Sustainable Development.

Gimba (2006) also added that computer can therefore; offer educators the opportunity to provide a new strategy to learning especially post-Covid-19 (after corona virus disease) Sustainable Development. These approaches can help students retain, transfer, and share what was learnt; develop interest in students to assimilate Mathematics more effectively. This could also help students to work together through collective and collaborative effort with the help of some instructional devices like Zoom, You-tube and whatsApp. Ability to understand information using several higher-level thinking skills (HLTS) to solve daily and complex problems can also be an added advantage. These could be achieved through the use of computer- assisted instructional (CAI) package in classroom instructions.

Ash (2005) defined CAI package as an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. It is a combination of text, graphics, sound and video in enhancing the learning process. Umaru (2003) defined CAI package as a program of instruction presented in computer software for instructional purpose. He also referred to CAI as the use of the computer as a tool to facilitate and improve instruction. CAI programs use tutorials, drill and practice; simulation, games, discovery and problem- solving approaches to present topics and then test the students' understanding. For the purpose of this study computer assisted instructional package is a tutorial activity that can present information through interactive approaches and can illustrate a concept through sound and animation. Gambari (2010) asserted that teachers can use computer- assisted instructional packages to arrest and sustain attention, present facts and information, teach concepts and principles, guide thinking and induce transfer of learning to enhance achievement in the Post-Covid and Sustainable Development.

Obi, Agwagah & Agah, (2014) defined Achievement as the ability to remember things. In their work on checkmating gender differentials in pupils' achievement in Mathematics using origami teaching aid, it was stressed that Achievement is the ability to retain what has been learnt. This implies that before Achievement comes into play, learning must have taken place.

Obi, (2014), when a person engages in practice of training activities and when observation of his performance shows that there is a change in performance; learning is usually assumed to have occurred. Simply put, learning is an observable change in behaviour and when one is able to recall what has been learnt as the need arises, it can be said that Achievement has taken place.

Furthermore, performance of students' is proportional to the amount of information retained and therefore the extent of achievement has to do with the degree of Achievement to enhance Sustainable Development in the post-COVID era.

The world submits on sustainable development report 2002 posit that sustainable development operates in three domains. They are economic domain-aims at reducing and seeking to eradicate

poverty, achieving higher levels of prosperity and enabling continued gains in economic welfare; Social domain-aims at reducing and seeking to eradicate other dimension of poverty, improving the quality of education, health, housing and other aspects of welfare of individual and communities, and enhancing the quality of social interaction, engagement and empowerment; Environmental domain- aims at reducing pollution and other negative impacts on environmental, mitigating effects of industrialization and human activity, and seeking to achieve sustainable use of resources in the interest of future generation (Azuka, 2006).

In spite of these efforts, Mathematics has not secured its rightful position in the mind of the students due to lack of instructional materials, poor Achievement, and poor method of teaching and so on. Research work of Gimba, (2006), Kurumeh and Imoke, (2008) has shown low academic achievement of students in Mathematics at all levels. Mathematics has posed threat to students because of the phobia associated to the subject when taught without instructional materials. This is regarded as the traditional method of teaching that makes students to view mathematical concept as abstract in nature; which may occur due to teachers teaching Mathematics without application of Mathematics theory.

The theoretical work of Van Hiele supported the teaching of geometry in mathematics in schools. The theory characterized learning geometry into four different levels as visual, descriptive, abstract and formal deduction. At the first level (visual), students identify shapes and figures according to their concrete illustrations. At the second level (descriptive) students identify shapes according to their properties, and here a student might consider square as a figure with four equal sides and angles. At the third level (abstract), students can identify relationships between classes of figures for example, that a square is a special form of rectangle and can discover properties of classes of figures by simple logical deduction. At the fourth level (formal deduction) students can make a short sequence of statements to logically justify a conclusion and can understand that deduction is the method of establishing geometrical truth. This theory advancing from one level to the next is more dependent upon teaching method than once age.

Given traditional teaching methods, research suggests that primary school students perform at most levels one and two, while senior secondary school students perform above level two. The explanation for this, according to theorist, is that teachers are asked to teach a curriculum that is at corresponding level with students' developmental age. With Van Hiele's Theory, it is not possible for learners to avoid a level. Generally, reasons for researcher great support of the Van Hiele levels is the usefulness in describing students' geometrical conceptual development on how well the theory reflects student's mental representations of geometrical concepts. The concepts of geometry a subset in mathematics is so relevant to Van Hiele theory of geometry. However, there are also some limitations identified with Van Hiele's theory such as the level of specification involving labeling of Diagrams in the primary and junior level as "visual" when visualization is demanded at all the levels and the fact that learners appear to show signs of thinking from more than one level in the same or different tasks, in different contexts.

Despite the importance of Mathematics to the nation, a review of the performance in both internal and external Mathematics examinations have shown that students performances have been poor in most Mathematics examinations such as WASSCE, SSCE coordinated by NECO and NABTEB. This has become a great concern to educators, parents, students, school administrators and also the entire society. In a related literature, Emaikwu, (2012) stated in his work "assessing the relative effectiveness of three teaching methods" …expresses a sad fall in the standard of achievement in Mathematics at all levels in Nigeria. With the trends in the Performance from West African Senior School Certificate Examination (WASSCE) back this claim.

These results are obviously not encouraging but rather frustrate not only the students affected, but also other students including Mathematics teachers in Nigerian schools as well as parents, guardians, and government. Research has shown that Mathematics is the bedrock of sciences, technology and development. Without Mathematics it would be difficult for the nation to move forward on sustainable development in the post- COVID era knowing full well the damages the Covid had cause the society, nations and countries.

In some Nigeria schools, traditional method of teaching is majorly the type of teaching method most teachers used in teaching Mathematics. This is no longer effective because it does not aid Achievement in this modern-day teaching and learning of Mathematics especially in the postCovid period. Emphasis should now be placed on the use of different types of teaching methods that could stimulate as many senses as possible in Mathematics classroom especially when teaching the mathematics which has poses difficulty for students to understand. (Nwaorgu, 2007). The mathematics classroom comprises of males and females term gender.

Danmole and Adeoye (2004) opined that there are no gender issues in Mathematics education on how it affects academic achievement and sustainable development in post Covid period. Literature review on Gimba, (2014) shows no gender differences on the use of CAI method.

However, Ezeugwu, (2013) on the order hand reviewed gender issues in terms of achievement showed that boys achieved Mathematics concept than girls. In addition, it was noted that the boys perform better than girls at activities that require manipulations. Other studies confirmed the superiority of female students' achievement over male students. However, some asserted and concluded from result of their findings that there are no gender issues in Mathematics.

Agwagah, (2000) opined that gender issues in Mathematics education as it affects achievement remain unresolved. Results of both internal and external examination still show students poor performance in Senior Secondary School Certificate Examination (SSSCE). Several research works had revealed poor teaching method as one of the causes of poor achievement of students in Mathematics examinations. Chief Examiner's Report of NECO (2009) revealed the poor attempt of students in answering questions that involves some topics in their Mathematics examination of 2009. This prompted the researcher to investigate the effects of Computer Assisted Instructional

(CAI) package in teaching mathematics in senior secondary school students' academic Achievement in Mathematics: Post- COVID period and Sustainable Development in Nigeria.

Purpose of the Study

The main purpose of this study is to investigate and determine the effect of Computer Assisted Instructional (CAI) package on senior secondary schools' students' Achievement in Mathematics: Post- COVID period and Sustainable Development in Abuja, Nigeria. Specifically, this study will determine:

1. Whether students taught Mathematics using CAI package during post-COVID period perform better than those taught the same concept using conventional method.
2. Whether difference exists between male and female Achievement when taught Mathematics using Computer Assisted Instruction (CAI) Package?

Research Questions

The following research questions were raised for the study:

1. What is the effect of Computer Assisted Instruction (CAI) Package on the mean Achievement score of senior secondary school students taught Mathematics using CAI package during post-COVID period compared to those taught the same concept using conventional method?
2. Is there any difference in the mean Achievement score of male and female students taught Mathematics using (CAI) Package?

Research Hypotheses

The following Null hypotheses are put forward to guide the study.

1. There is no significant difference in the mean Achievement score of students taught Mathematics using CAI package during post-COVID period compared to those taught the same concept using conventional method?
2. There is no significant difference in the mean Achievement scores of male and female students taught Mathematics using CAI Package and conventional method.

Research methodology

This study employed a quasi-experimental research design (non-randomized, non-equivalent, pre-test, posttest control group design). The design measures the effect of Computer Assisted Instructional (CAI) Package, as the treatment for independent variables on learning Mathematics while Achievement served as the dependent variable. Two (2) groups of subjects were randomly assigned using an intact class in other to investigate the effects on pre-test and posttest. Computer Assisted Instructional (CAI) package serves as treatment to the experimental group, while the Control Group was without treatment. Pretest was administered to the two groups, in order to

ascertain the students' academic differences in term of performance level and preparedness. The tool employed was an instructional lesson plan which covers sub-topics of SS two Mathematics scheme of work.

The target population of the study consisted of all senior secondary school two students in public secondary schools in Federal Capital Territory Abuja. The sampling technique employed was multi stage sampling techniques. One hundred and seventy-eight (178) SS2 students comprising 90 male and 88 female students served as sample size. These numbers of students were selected from two different co-educational public Senior Secondary School (SSS 11) in Kwali Area Council, Abuja namely GSS Kwali and GSS Yangoji. Kwali area council was selected using simple random sampling technique among the six Area councils in Abuja. The choice of senior secondary two is appropriate because Mathematics taught at this level is to prepare students for external examination such as SSCE and others.

The instrument employed for the study, was Mathematics Achievement Test (MAT) of 30 multiple choice items. The MAT was developed and validated by the researcher and two other experts from Mathematics education. In other to standardized the instrument of options A, B, C and D before accepting the 30 multiple choice Mathematics test, out of 40 questions table of specification, item difficulty index (IDI) and item discriminating power (IDP) were calculated for all the items. The reliability of the test instrument was determined using correlation coefficients. A correlation coefficient of 0.86 index score was obtained which was considered high and suitable for gathering data. The instrument was certified to have face and content validity by experts.

To validate and authenticate the lesson plan, it was giving to three experts, the expert rating scales for the tools on the appropriateness of the lesson plan, out of 100 points, were 85%, 88% and 90% and the mean rating was 87.7% representing the content, consensus or logical validity of the lesson plan. The students received the treatment of Mathematics Achievement test by the students' regular Mathematics teacher using researcher prepared lesson plan. The training for Mathematics teachers lasted for one week in the sampled schools. The control group received no treatment but all of them were taught mathematics by their Mathematics class teacher using researcher prepared lesson plan to make for uniformity in the presentation of the lessons in the experimental and control group classes.

Data collected were subjected to descriptive and inferential statistics. Descriptive statistics such as mean and standard deviation were used to answer the research questions while inferential statistics such as student t-test was used to test the hypotheses. Hypotheses were tested at 0.05 level of significant using Statistical Package for Social Science (SPSS) version 21.0.

RESULTS

The presentation of the pretest results of Mathematics Achievement Test (MAT) shows the entry levels of the Experimental and Control groups.

Research Question One

1. What is the effect of Computer Assisted Instructional (CAI) Package on the mean Achievement score of senior secondary school students taught Mathematics using CAI package during post-COVID period compared to those taught the same concept using conventional method?

Table 1: Mean and Standard Deviation for research question results of experimental group (CAI) and control Group using conventional method.

S/no	Descriptive Tools	Control Group	Experimental Group	Mean Gain
1.	Mean	32.45	73.86	41.32
2.	Standard Deviation	24.54	18.73	

From table 1, the mean values of both the control group (CG) and Computer Assisted Instructional (CAI) package that were taught with the experimental Group (CAI) on concept of mathematics are 32.45 and 73.86 while standard deviation is 24.54 and 18.73 respectively; the mean gain is 41.32 which are in favour of the experimental group (CAI).

Research question 2

Is there any difference in the mean Achievement score of male and female students taught Mathematics using computer assisted instructional (CAI) package?

Table 2: The Mean and Standard Deviation for research question results of experimental group (CAI) on gender difference on Achievement test.

S/no	Groups	Mean	Standard Deviation	Mean Difference
1.	Male	51.00	6.83	9.00
2.	Female	60.00	7.19	

From table 2, the mean values of male=51.00 and female =60.00 students taught Mathematics using Computer Assisted Instructional (CAI) package, while standard deviation is 6.83 and 7.19 respectively. The mean difference is 9.00 which are in favour of the female students using the same concept

HYPOTHESIS TESTING 1. Hypothesis One

There is no significant difference in the mean Achievement score of students taught Mathematics using CAI package during post-COVID period compared to those taught the same concept using conventional method?

Table 3: t-test results of Exp. (CAI) and control group (CG) on Achievement

Groups	N	Mean	Std.	Df.	t-value	p-value

CAI	30	73.86	18.73	58	0.512	0.026
CG.	30	32.45	24.54			

S = significant p 0.05

Table 3: Shows t-test results of experimental and control group of students taught Mathematics using Computer Assisted Instructional (CAI) package in achievement test. The Mean result of CAI was (73.86) and CG mean score was (32.45) with a Mean difference of 41.41 in favour of the CAI, the difference was statically significant. The results revealed t= 0.512 df= 58. P= 0.026. Since, P (0.026) <0.05. Hence, $H0_1$ was rejected. This shows that there was significant difference based on the effect of CAI in mean Achievement score on CAI package during post-COVID period compared to those taught the same concept using conventional method?

Hypothesis Two

$H0_2$ There is no significant difference in the mean Achievement scores of male and female students taught Mathematics using Computer Assisted Instructional (CAI) package.

2. Table 4: t-test results of Exp. (CAI) on gender difference Achievement test.

Groups	**N**	**Mean**	**Std.**	**Df.**	**t-value**	**p-value**
Male	30	51.00	6.83	58	0.632	0.554
Female	30	60.00	7.19			

Ns= Not significant at p>0.05

Table 4: Shows t-test results of male and female group of students taught Mathematics using CAI during Achievement test. The Mean result of male was (51.00) and Female Mean score was (60.00) with a Mean difference of 9.00 in favour of the female. The results also revealed t= 0.632, df= 58, P= 0.554. Since P> 0.05, $H0_2$ was retained. This shows that there was no significant difference based on gender in Achievement test on CAI.

Summary of Findings

The following findings were recorded based on the statistical analysis: Students taught Mathematics using CAI package during post-COVID period achieved better than those taught Mathematics using the conventional method of teaching. Female students taught Mathematics using CAI package achieved more than the male students taught Mathematics using CAI package. The female students' Achievement did not differ significantly from the male Achievement.

Discussion

The result revealed that there is significant difference in the achievement of students taught Mathematics using Computer Assisted Instructional (CAI) package and those taught with the

conventional method, this was in favour of the students taught mathematics using Computer Assisted Instructional package. This result agreed with Afolabi (2004), Gimba (2010) and Gambari etal. (2014) which confirmed that computer assisted instruction has been effective in enhancing students' achievement than the Conventional method of instruction. This higher achievement of Computer Assisted Instructional (CAI) package could be attributed to these advantages, such that students' may likely own their personal computers, transfer information through zoom, WhatsApp and Bluetooth even at home, and also be familiar with computer practices (drill and practice).

Secondly, the high achievement may also be due to the availability of student's personal selftutorial computer (self-directed learning) in the teaching. The teacher serves as guide to the students. The method employed help students understand and gain the knowledge in their own way. The students' high achievement can also be as a result of the student's ability to playback (self-discovering) the lesson package to enhance recapitulation on the lesson. Furthermore, the findings revealed little or no gender differences in achievement of males and females in Mathematics. There was significant difference on students taught Mathematics using CAI package compare to those taught Mathematics using the conventional method of teaching.

CONCLUSION AND RECOMMENDATIONS

The following conclusions were made based on the findings of this study. The result of this study provides empirical evidence that the use of Computer Assisted Instructional (CAI) package during post-COVID period, enhanced students' Achievement in Mathematics more than the use of conventional teaching method. Therefore, teacher should be discouraged from the use of conventional method of teaching Mathematics.

The following recommendations were made based on the findings of this study; since the use of CAI package during post-COVID period enhances achievement of students in Mathematics, the Mathematics teachers should use it as one of the strategies to be employed in classroom teaching and learning for sustainable development. Workshops/Seminars should be organized by the Government for Mathematics teachers to enable them learn how to develop software packages to enhance the teaching and learning of Mathematics in schools and also learn how to use computer in teaching Mathematics to promote computer literacy among teachers especially during postCOVID period for sustainable development.

Mathematics curriculum developers should embrace and include computer assisted instructional strategies that will bring about creativity, improvement in learning, acquisition of critical thinking, problem solving and performance skills in students into Nigerian Mathematics curriculum.

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