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EFFECTS OF COMPUTER INSTRUCTIONS ON ATTITUDE, AND ACADEMIC PERFORMANCE IN TRIGONOMETRY AMONG SENIOR SECONDARY SCHOOL STUDENTS IN OKENE

BY

[1]DHARRIYAT SALAMI AND [2]UMAR SANI

[1]Science Education Department,
Prince Abubakar Audu University,
Anyigba, Kogi State.
[2]Department of Mathematics,
Jigawa State of College Education and Legal Studies,
Ringim. umarsanisarauta@gmail.com

Corresponding Author: rockschamber@gmail.com*

Abstract

This study investigated the effect of computer instructions on the attitude, and academic performance of students in trigonometry among senior secondary schools in Okene. The study was guided by two research questions and null hypotheses at 0.05 level of significance. The population of this study comprised 563 male students and 399 female students with a total of 962 Senior Secondary School II students of both mixed and single-sex from government-owned schools in Okene of which 67 subjects were sampled for this study with the use of deliberate effort as supported by central limit theory. The researcher employed a pretest and posttest quasi-experimental design. In this study, two instruments were used, Trigonometry Performance Test and the Trigonometry Attitude Questionnaire. The reliability coefficients of the instruments were 0.74 and 0.86 for performance and attitude respectively. Mean and standard deviation were used to answer the responses to the research questions, and the Mann-Whitney U test, and t-test were used to test the null hypotheses at a 0.05 level of significance. The results showed a significant difference exists between the attitudes of students taught trigonometry using computer instruction and those taught using the conventional method in favour of the former students. It is recommended by the researcher based on the findings that the government should provide all the necessary facilities needed for the implementation of computer instruction in the educational system

.*Keywords:* Computer instruction, conventional method, performance, attitude and trigonometry.

Introduction

Students' performances, and attitude in mathematics examinations in Nigeria are becoming a disturbance to teachers and parents which calls for immediate attention. Over the years, the student's achievement in the sciences, most especially in mathematics has been below expectations (Akanbi, Omosewo, and Ilorin. 2018; Ugwuanyi, Elejere, Gana, Macmillan, Abraham, Ugwuanyi, Ezeugwu, and Ogili, 2019). Ugwuanyi et al (2020) found that not minding the role of mathematics in the Nigerian education system, students' performance in both external and internal examinations is on a downward trend. Azuka (2013) stated that out of the major factors that influence students' performance, and attitude, teacher factors appear prominent. According to Ugwuanyi et al. (2020), information communication technology (ICT) has a significant impact on student's performance, especially in this twenty-first century world. This implies that the method of instruction adopted by the teachers largely determines the performance of students in mathematics. There is an urgent need for a paradigm shift in the methods by which the contents of mathematics are passed on to the students, especially in twenty-first-century classrooms. The use of Computer systems especially Multimedia projection in teaching can be a solution to the performance, and attitude of students. This is supported by Kyungbin, Anne, Thomas, Minj, and Ge (2021), students communicated relatively positively towards computer instructions. The use of computer instructions has been effective in teaching all domains of subjects and improved students' attitudes towards learning the traditional method of teaching (Ozgur and Taya, 2021). The use of multimedia projection, a subset of Information and Communication Technology (ICT), can enhance teaching and learning. Thus, every teacher must be ICT literate in all ramifications (Azare, 2019). Computer Instruction (CI), is another type of e-learning that uses computers together with conventional teaching. Computer instruction training methods use a combination of multimedia such as text, graphics, sound, and video to enhance learning. The primary value of CI is interactivity – it allows students to become active learners instead of passive learners, by utilizing various methods such as quizzes and other computer instruction teaching and testing mechanisms. Most schools nowadays, both online and conventional, use different variations of computer instructions to facilitate the development of skills and knowledge in their students. A student is expected to acquire certain knowledge and cognitive skills as he/she progresses through the school system so that when he/she graduates he/she can perform productive tasks in an increasingly knowledge-based economy.

Birgin and Yazici (2022) investigate the effect of using dynamic geometry software (GeoGebra) on eighth-grade students' conceptual understanding and the retention of learning regarding linear equations and slopes. In this study, a quasi-

experimental design with pre-test, post-test, and delayed post-test was employed. This study was conducted with 52 eighth-grade Turkish students (experimental group, $n = 25$; control group, $n = 27$). While GeoGebra software-supported instruction was carried out in the experimental group, textbook-based direct instruction was continued in the control group. Data were collected with the conceptual understanding test (CUT) which consists of 38 questions including open-ended, multiple choice, and fill-in-the-blanks. CUT was applied to the experimental and control groups as a pre-test and post-test at both the beginning and the end of the instruction, respectively. Seven weeks after the instruction, CUT was applied to both groups as a retention test. Data were analyzed through SPSS 17.0 statistical software by using a *t*-test and ANCOVA test. It was indicated in the study results that GeoGebra software-supported instruction for eighth-grade students regarding linear equations and slope significantly improved both their conceptual understanding and retention of learning in comparison to textbook-based direct instruction. This study is quite similar to the present study but the attitudinal change of students wasn't captured which this present study, the effects of computer instructions on academic performance, and attitude have been captured and found.

The study by Yunusa and Geraldine (2020) to determine the impact of computer-assisted instruction (CAI) on teaching and learning in Nigeria. The methodology adopted for the study is secondary data analysis. Two research questions were used in the study to a logical conclusion. The concept of CAI is discussed. CAI was assessed as having powerful features that could positively improve the performance of teachers and learners in Nigeria and thus transform the education system. However, the study identified some factors militating against the adoption and efficient use of CAI in Nigeria, such as inadequate funding of the education sector, a poor maintenance culture, and the lack of a constant supply of electrical power. Given the findings, the recommendations include the need for adequate funding of the education sector, proper training of staff on the application of CAI, and regular supervision of schools to improve the adoption of CAI in the education system in Nigeria. However, this study was able to outline factors affecting the use of CI but failed to find CI's effects on performance, and attitude which this present study was able to find as shown in in table 3 and 4.

Isiaka, Victoria, and Romanus (2014) examined the effects of two modes of computer-assisted instructional packages on solid geometry achievement amongst senior secondary school students in Minna, Niger State, Nigeria. Also, the influence of gender on the performance of students exposed to CAI (AT) and CAI (AN) packages was examined. This study adopted a pretest-posttest experimental design with a 3 x 2 factorial design and a sample of 120 Senior Secondary class Two (SSII)

students (60 male and 60 female). Computer-assisted instructional packages of two modes; Animation with Text (AT), and Animation with Narration (AN) were employed as treatment instruments and a Solid Geometry Achievement Test (SGAT) was used as a test instrument. A trial test was carried out and a reliability co-efficient of 0.78 was obtained using the KR-21. Analysis of Variance (ANOVA) and t-test were used in analyzing the data collected. The study revealed that there were significant differences in the post-test mean scores of CAI(AT), CAI(AN), and the control group ($F = 11.468$, $df = 119$, $p<0.05$) and the Scheffe's post-hoc test revealed a significant difference between CAI(AN) and the lecture method groups, favoring CAI(AN), there was no statistically significant difference in the post-test mean scores of male and female students taught using CAI(AT) ($t=0,660, df=38$, $p>0.05$) and CAI(AN) ($t=1.455$, $df = 38$, $p>0.05$). Based on these findings, it was therefore recommended that Mathematics teachers should be encouraged to use CAI (AN) for meaningful and effective teaching and learning of Mathematics. In this study, the researcher found results that are in agreement with the present study but failed to find out the effects of CI on the attitudinal level of the students which this present study, the effect of computer instructions on academic performance, and attitude of senior secondary school II in trigonometry was able to established as shown in table 3 and 4. Gambari, Falode, and Adegbenro (2014) found that there was a significant effect of computer animation on the mean achievement scores of students in geometry. Falode, Usman, Ilobeneke, Mohammed, Godwin, and Jimoh (2016) found that students taught Agricultural Science through a computer animation instructional package performed better than their counterparts taught the same concept with the lecture method. Etim, Itighise, and Ema (2016) found that computer animation learning course wave had a positive effect on student's academic performance. Anigbo and Orie (2018) revealed that the Microsoft PowerPoint Instruction Strategy had a significant effect on students' achievement. Ruzicka and Milova (2019) found that the use of video analysis in providing feedback has a positive effect on the process of downhill skiing skills acquisition. Ugwuanyi et al. (2019) found that flipped classroom instructional technology was effective in enhancing the achievement of physics students at both post-test and follow-up measurements. Ugwuanyi and Okeke (2020) found that computer-assisted Instruction (CAI) had a significant effect on university students' achievement in physics. Ugwuanyi et al. (2019) found that PowerPoint presentations had a significant effect on students' achievement in physics and mathematics. Ugwuanyi et al. (2020) found that animated PowerPoint presentations (PPT) significantly enhanced the achievement of students in physics. This research was on Physics students' performance but the present study was on the performance, and attitude of students in senior secondary schools.

Ugwuanyi et al. (2020) found that digital game-based learning significantly ($p < .05$) improved the achievement of primary school pupils at both the post-test and follow-up measures. The forgoing indicated that computer-based instructional strategies are effective in enhancing students' motivation to learn as well as their achievement in science and social science subjects. This study evaluated the impact of CAI on students' achievement in mathematics and physics. The researchers hypothesized that computer-assisted instruction would have a significant impact on students' achievement in mathematics and physics. This study by Eunice, Christian, Chinedu, Boniface, Uche, Chika, Pauline, Mercy and Agnes (2020) evaluated the impact of computer-assisted instruction (CAI) on Mathematics and Physics students' achievement. Quasi-experimental, nonequivalent group design was adopted for the study using a sample of 200 participants. Mathematics Achievement Test (MAT) and Physics Achievement Test (PAT) were used to collect data for the study. The internal consistency reliability indices of the MAT and PAT were estimated as 0.89 and 0.75 respectively using Kuder-Richardson formula 20. The hypotheses were tested at 0.05 levels of significance using analysis of covariance. It was found that Computer-Assisted Instruction (CAI) significantly improved mathematics and physics students' achievement. This finding has implications for Industrial Technical Education the fact that improved achievement of students in Mathematics and Physics subjects at the secondary education level will enable them to have an interest in industrial technical education at higher education. Thus, Mathematics and Physics teachers should be trained on how to master the techniques needed for the preparation and use of the CAI package for effective teaching and learning of different concepts in Mathematics and physics. This study is similar to the present study in the area of Mathematics concept, and performance but failed to find out the effects of CI on attitude of students which this present study, effects of computer instructions on academic performance, and attitude of students in trigonometry. In another study Essien and Adie(2018), a comparative analysis of Computer-assisted instruction and traditional (lecture) methods of teaching and learning Social Studies at the College of Education Akamkpa, Cross River State was investigated. The objective of the study was to determine if there is a significant difference in the effects of the treatment and control groups as measured by the pretest and posttest. The population of the study was a class of Sixty (60) College students in Social Studies taught with the use of CAI and another class of Sixty (60) students taught with the use of the traditional (lecture) method. There was no sampling since the entire population was used. The research method used was a quasi-experimental, non-equivalent control group design. The statistical tool was the t-test. The researchers made use of the CDROM prepared to serve as the teaching medium for the experimental group. A 10-item questionnaire was also used to seek the opinion of the students on the effectiveness of both teaching methods (CAI and traditional). The findings of the study revealed that the

achievement posttest of the treatment group has higher estimated marginal values than the control group. The result of the study also showed that the combination of CAI and collaborative work improves teaching and learning. Despite the limitation of the study being conducted in one classroom, with one teacher and Sixty (60) students, the result cannot be generalized to other schools. Conclusively, it was recommended among others that teachers should attempt to be ICT compliant to enhance their chances of using CAI innovative in teaching social studies. This research didn't find the effects of CAI or CI on attitude but in this present study, the effects of computer instructions on academic performance, and attitude on senior secondary school II students have been found and shown in table 3 and 4.

The study by Usman and Jilang (2018), investigated the Effects of Computer-assisted Instruction, (CAI) on Students' achievement and interest in Secondary School Physics in Jos North Local Government Area, Plateau State. This study was motivated because of the prevalence of poor students' performance in physics which was due to defective methods of teaching used by teachers. The design used in this study was quasi-experimental. Specifically the pretest-posttest control group design. The sample of the study comprised eighty-five (85) SS2 physics students in Jos North local government area of Plateau State Nigeria. Three research questions and four hypotheses were formulated to guide the study. Two instruments namely the Physics Achievement Test (PAT) and the Physics Interest Questionnaire (PIQ) were used to collect data for the study. The PAT consisted of 40 items which were developed based on the concept of units and measurements, motion, vectors, projectile, and simple harmonic motion while PIQ consisted of 16 items. The two instruments were validated by two experts a Prof. of physics education from the Department of Science and Technology Education University of Jos and a senior lecturer from the Test and Measurement Unit in the Department of Educational Foundation all in the University of Jos. The reliabilities of the two instruments PAT and PIQ were computed and the indexes stood at 0.85 and 0.88 respectively. Data collected for the study were analyzed with the use of simple percentages, t-tests, and analysis of variance (ANOVA) using SPSS version 22. The findings of the study revealed that the use of CAI helped in enhancing students' achievement in physics, and helped in improving students' interest in physics.

Statement of the Problem

The method of acquiring useful knowledge in mathematics via computer instruction has become a thing of necessity, especially in a digital generation as we have all over the world. Students enjoy multimedia these days as they want to see moving pictures. Computer education will combine their enjoyment with learning mathematics. Studies showed that computer instruction enhance performance, and attitudes Jose-Maria, Immaculada and Francisco-Javier (2020), Kim and Park (2019), Eunice et al (2020), Jeya and Brandford (2019), Anigbo and Orie (2018)).

However, these studies were conducted elsewhere and findings may not be generalized to the target population due to economic, social, and political differences. Hence, the purpose of this study is to determine the effect computer instructions on attitude, and performance of students in trigonometry among senior secondary school II students in Okene. Mathematics plays an important role in all fields of education and being one of the compulsory subjects offered at the secondary school level of our educational system calls for a way to study it at all costs. Despite various means of teaching and learning which conventional method is one of the most used methods in the teaching of mathematics, the performance of students in this area seems to be what calls for concern in the educational sector of the country, the constant insecurity in the country, hard economy, low interest of students towards learning among other disturbing factors in Nigeria toward our educational system is a big problem which bothers me as a researcher that propelled the researcher to want to find a solution which is affordable, and compatible to all willing to learn, unlearn and relearn. It is in line with these stated above that this study investigated the effect of computer instructions on the attitude, and performance of students in trigonometry among senior secondary schools in Okene.

Research Objectives

The objective of this study is to determine the effect of computer instructions on attitude, and academic performance of students in trigonometry among senior secondary school students in Okene. In specific terms, the objectives of this study were to:

1. evaluate the effect of computer instructions and conventional methods on the attitude of students in trigonometry
2. access the effect of computer instruction and conventional methods on the performance of students in trigonometry

Research Questions

In this study, the researcher raised and answered the following research questions:

1. What is the difference between the mean attitude of students taught trigonometry using computer instruction and those taught using the conventional method?
2. What is the difference between the mean performance of students taught trigonometry using computer instructions and those taught using conventional methods?

Null Hypotheses

The following null hypotheses were formulated and tested at a 0.05 significance level, which is as follows:

H01: There is no significant difference in the mean attitude of students taught trigonometry with the use of computer instruction and conventional methods among students.

H02: There is no significant difference in the mean performance scores of students taught trigonometry with the use of computer instructions and conventional methods among students.

Methodology

I adopted a pretest and post-test group design as recommended by Kothari (2014). Two groups were involved, which was one experimental and one control group. Each group was pre-tested (O_1) to ascertain the homogeneity. After the pretest, the experimental group received experimental treatments (X_1) while the control group received no treatment (X_2). After that, both groups were subjected to a post-test (O_2) to measure their performance. The design is illustrated in the figure 1

EG: $O_1 \longrightarrow X_1 \longrightarrow O_2$ (Computer Instruction)

CG: $O_1 \longrightarrow X_2 \longrightarrow O_2$ (Conventional Method)

X_1: Computer Instruction (treatment)

X_2: Conventional method (control)

O_1: Pretest Administration

O_2: Posttest Administration

EG: Experimental Groups

CG: Control Group

Figure 1: Research Design Illustration (Adopted from Kothari, 2014)

The population of the study was nine hundred sixty-two (962) with 563 male students and 399 female students of Senior Secondary School II (SSS 2) students drawn from thirteen (13) public schools in Okene. The schools are in urban and rural areas which are made up of both single and coeducational schools. Public schools were selected for their conveniences such as Staffing; the teachers, infrastructures, curriculum, buildings, and classrooms were averagely the same. The students were exposed to the same trigonometry syllabus in line with the federal government's objectives for secondary school education. The sample was selected using a non-probability sampling which is characterized using judgment and a deliberate effort to obtain representative samples by including typical groups in the sample. The sample size for this study was a total of 67 subjects as shown in Table 1

Table 1
Sample Size

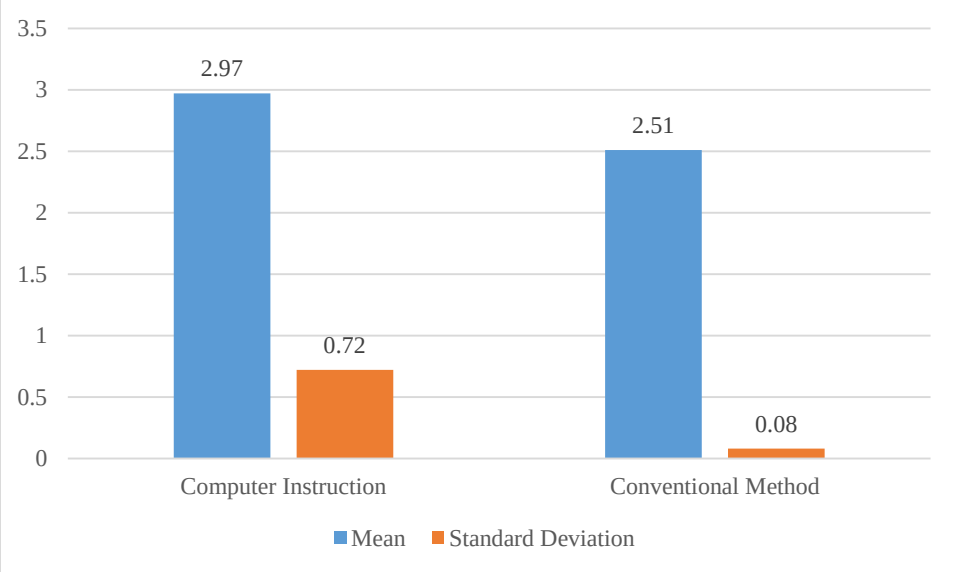
School	Male	Female	Total
A	15	17	32
B	16	19	35
Total	31	36	67

The measuring tools used in this study include the Trigonometry Attitude Questionnaire (TAQ), and the Trigonometry Performance Test (TPT). Trigonometry Performance Test: This instrument was 40 objective questions with options A-D, drawn based on trigonometry topics such as triangle theorem, Pythagoras theorem, trigonometric ratio, sine rule, and cosine rule that was taught. Trigonometry Attitude Questionnaire This was 62 items on the: computer importance which was 7 items (items 3, 6, 7, 8, 9, 10, and 11); computer enjoyment was 9 items (1, 2, 4, 5, 9, 12, 13, 16, and 19); computer habits which were 10 items (21, 24, 25, 26, 29, 30, 31, 32, 33, and 34), computer motivation which was 8 items (item 21, 22, 23, 25, 27, 28, 29, and 34); empathy which were 10 items (item 36, 37, 38, 39, 40, 41, 42, 43, 44, and 45) creativity tendency which were 13 items (item 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57 and 58); school which were 4 items (item 59, 60, 61, and 62) and anxiety which were 8 items (item 12, 13, 14, 15, 16, 17, 18, and 19). This instrument was adapted from the Computer Attitude Questionnaire version 5.14. The response mode was using a four-level Likert scale of Strongly Agreed (SA), Agreed (A), Disagreed (D), and Strongly Disagreed (SD).

Question One: Is there any effect of computer instruction and conventional methods on the attitude of students in trigonometry?

Figure 2

Mean and Standard Deviation Statistics on Difference between the Mean Attitudes of Students Taught Trigonometry with the Use of Computer Instruction and Conventional Method



Results of the Mean and Standard Deviation statistics in Figure 2 revealed that Computer instruction has a positive effect on the attitude of students in trigonometry. Their computed mean are 2.97 and 2.51 by students taught trigonometry with the use of Computer instruction and conventional methods respectively indicating a mean attitude change of 0.46 in favor of students taught trigonometry with the use of Computer instruction. .

Hypothesis Two: There is no significant difference between the mean attitude of students taught trigonometry with the use of computer instruction and conventional method.

Table 2

Man Whitney Non-Parametric Statistics on Difference between the Mean Attitudes of Students Taught Trigonometry with the Use of Computer Instruction and Conventional Method

	Groups	N	Mean Rank	Sum of Ranks	Mann-Whitney U	P-Value
Attitudinal Changes	Exp 2	32	51.42	1645.50	2.500	.000*
	Control	35	20.29	710.00		
	Total	67				

*****Significant difference exists between experimental and control groups since the p-value is less than .05*

Results of Table 2 revealed that there is a significant difference between the attitudes of students taught trigonometry with the use of Computer instruction and conventional method. The reasons are that the calculated p-value of .000 is lower than the 0.05 alpha level of significance. Their computed Attitudinal change levels are 51.42 and 20.29 by students taught trigonometry with the use of Computer instruction and conventional method respectively indicating a mean attitudinal change of 31.13 in favor of students taught trigonometry with the use of computer instruction. Therefore the null hypothesis, that there is no significant difference between the attitudinal changes of students taught trigonometry with the use of computer instruction and conventional learning, is hereby rejected

Question two: What is the effect of computer instructions and conventional methods on the academic performance of students in trigonometry?

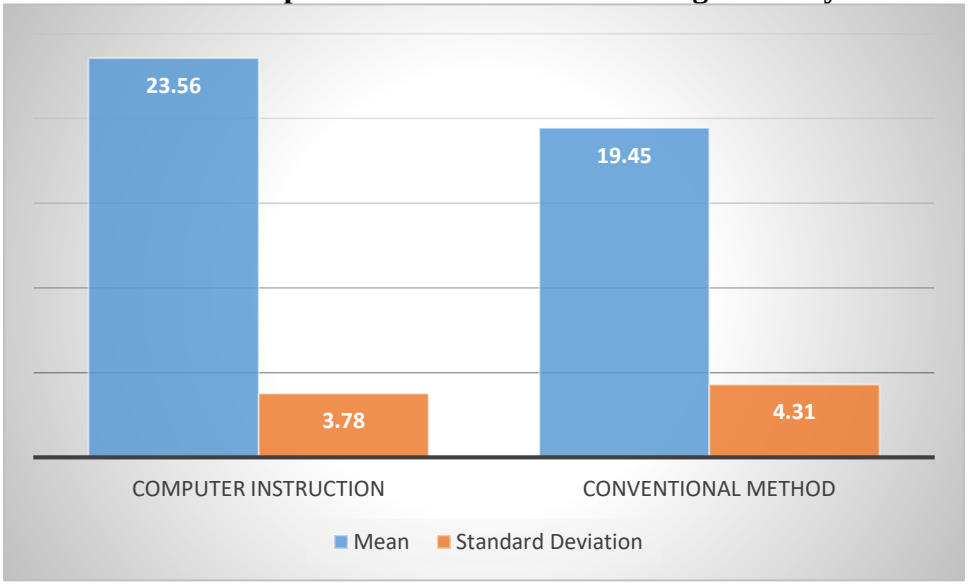


Figure 3: Descriptive Mean Statistics on the Effect of Computer Instructions and Conventional Methods on the Academic Performance of Students in Trigonometry

The descriptive mean statistics in Figure 3 above revealed that computer instructions have a high positive effect on the academic performance of students in trigonometry with their mean performances as 23.56 and 19.45 by students taught trigonometry using computer instructions and conventional learning respectively with mean difference of 4.105 in favor of students taught trigonometry using computer instructions.

Hypothesis Four: There is no significant difference in the mean performance scores of students taught trigonometry with the use of computer instructions and mobile instruction.

Table 3

Independent T-Test Statistics on the Difference between Mean Performances of Students Taught Trigonometry Using Computer Instructions and Conventional Method

Variables	Study groups	N	Mean	STD	Mean difference	df	t-value	P-Value
Mean Performance	Exp2	32	23.56	3.783	4.10536	65	4.128	.000*
	Control	35	19.45	4.306				

Significant difference exists between experimental and control groups since the p-value is less than .05

Table 3 of independent t-test statistics shows a significant difference exists between the mean performances of students taught trigonometry using computer instructions and conventional methods. The reason is that the calculated p-value of .000 is below the 0.05 alpha level of significance at df 65. Their mean performances are 23.56 and 19.45 by students taught trigonometry using computer instructions and conventional method respectively with a mean difference of 4.105 in favor of those taught trigonometry using computer instructions. Therefore the null hypothesis, that there is no significant difference in the mean performance scores of students taught trigonometry with the use of computer and mobile instructions, is hereby rejected

Summary of Findings

1. There is a significant difference between the mean attitude scores of students taught trigonometry with the use of computer instruction and conventional method. Their calculated mean attitude levels are 2.97 and 2.51 by students taught trigonometry with the use of computer instruction and conventional method respectively indicating a mean difference change of 0.43 in favor of students taught trigonometry with the use of computer instruction. *P = 0.000 < 0.05, Mann Whitney U = 2.500 > z score of -7.03*
2. Significant differences exist between the mean performances of students taught trigonometry using computer instructions and conventional method. Their mean performances are 23.56 and 19.45 by students taught trigonometry using computer instructions and conventional method respectively with a mean difference of 4.105 in favor of students taught trigonometry using computer instructions. *P = 0.000 < 0.05, t computed = 4.128 > t critical of 1.96 at df 65*

Discussion

The result of Table 2 was also supported by the earlier work of Gambari et al. (2014), where they found that a significant effect exists with the use of computer-assisted instruction on students' attitude when compared to the traditional teaching method. Folade et al (2016) also found that students taught through the computer animation instructional packages performed better than their counterparts taught with the lecture method. Anigbo and Orie (2018) revealed that the Microsoft PowerPoint Instruction Strategy had a significant effect on students' achievement. All in support of Table 2. Ugwuanyi and Okeke (2020) found that computer-assisted Instruction (CAI) had a significant effect on university students' achievement in physics. Ugwuanyi et al. (2019) found that PowerPoint presentations had a significant effect on students' achievement in physics and mathematics. Ugwuanyi et al. (2020) found that animated PowerPoint presentations (PPTs) significantly enhanced the achievement of students in physics. Ugwuanyi et al. (2020) found that digital game-based learning significantly ($p < .05$) improved the achievement of primary school pupils.This study by Eunice *et al* (2020) also supported the result of this finding, it was found that Computer-Assisted Instruction (CAI) significantly improved mathematics and physics students' achievement. These all supported the result of Table 3.

Conclusion

It is, therefore, concluded from the analyses of this work that computer instruction has a positive effect on the attitude of students in trigonometry. Computer instructions have a highly positive effect on the academic performance of students in trigonometry.

Recommendations

The researcher put forward the following recommendations

1. The government should provide all the necessary facilities needed for the full implementation of computer instructions
2. There should be a constant power supply for the smooth running of these strategy
3. The attitude of students can be sustained and enhanced in students' academic performance in trigonometry by using qualified teachers
4. There should be motivational techniques put in place for both students and teachers who excel in the art of teaching mathematics through intrinsic motivation and extrinsic motivational programs put in place by the school's management.

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