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An Investigation of the Competency of Physics Students in the Use of Scientific Software in Studying Physics Course (A Case Study Ambrose Alli University).

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Abstract
Physics is a course or discipline studied at the university level of Education, it has a wide and profound impute in the field of present day digital devices. Modern day technological innovations requires the use of scientific software for design and simulations. Achieving this, an experimental research was carried in a higher institution to investigate the level of students competency in application of these software in Ambrose Alli University. A total of 120 students were selected for the exercise which pretested before they will undergo treatment and will be post tested as the experimental group and 120 students for the control group. The experimental group in this research is the group that was taught by the use of software (student-centered) by experts after been pretested without the prior knowledge on the use of the scientific software. The instrument for the collection of data will be Achievement Test in physics scientific software (ATPSS).The t-test statistics was used to analyze the data used for the study at alpha level of 0.05. Result from research shows that students performed better after they were taught on how to use these scientific software. A number of recommendations were made on the consequences of software application in this study.

Keywords: Software, Physics, Technology &Scientific

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I. Introduction

Physics is one of the basic sciences course which study energy and forces that touch our lives daily at every point. It involves the study of nature and underlying principles that govern behaviour of the whole universe and all physical things in it, be it living or non-living(Onomendo&Sadiq,2020).Teaching and learning of physics requires more of its practicals in practice than theory for proper understanding of the area thought to reduce abstract idea in physics, this led to the construction of laboratory with physics equipments and installation of computers with different software design to enable students observe and practice some theoretical explanation through the use of software based on the study area.

The study of physics over the years is attached to practicals in the physics laboratory which is a stimulating and motivating tool to learning it as a course to eradicate abstract and clumsy look when studying it theoretically. During these laboratory activities responses are observed from students which in turn downcast the learning action, tiresome and most often difficult to assimilate. These led to the innovation and implementation of design and simulation of computer package technologies in the teaching and learning of physics in various aspect to recover the lost interest and passion in physics study(Cortini, 1992).

However, different aspects of physics have their various software packages designed for them to enable the collection and analysis of experimental data for new physics pedagogy (Vagner,1998). Scientific software is a set of computer program designed with instruction in the field of science discipline stored in digital computer memory to solve problems based on the instructions given and designed for the program in the computer to have a final results in terms of theory, mathematical relations or diagrams and simulations (Evans,2018). There are various types of software which are used in different aspects of physics are as follows: ABINIT,AIDA(computing),ALEGRA,Algodo,APFEL(software),ASTOS,Atomistix ToolKit, Atomistix Virtual Nano Lab, Avizo(software), Biskit, Car-Parrinello molecular dynamics, CASINO,CASTEP,CFD-ACE+,CFD-FASTRAN,CICE(sea ice model),CLHEP, Community Earth System Model, CopmHEP, List of computer-assisted organic synthesis software,CONQUEST,CORSIKA,CP2K etc. The introduction of software encourages the designs and simulations to make data imputed into the computer scientific software results a reality before practical design and constructions is carried out by the Engineers. Software play a key role in documentation and computations in the area of mathematical physics to spelt out orderly how answers are arrived at (Vagner,2008). Use of computers and software ICT tools in classrooms and laboratories, provide much more effective and efficient environments in teaching and learning, making living skills easier to understand. In line

with a number of researchers in ICT education Guiliana (2002), teaching approaches that are based on the understanding of software principles for problem solving involve three major components(Abu,2016). It is important to generate understanding using situated examples, visualizations, and dialogues. By using situated examples, the teacher should enable the students to understand the software problem. The principles of the software are then explained through visualizations.

Over the years, the use of computer software technologies in teaching and learning physics have been unfolding in developing countries. For a developing country like our dear nation Nigeria to be part of this computer software technology in teaching and learning of physics, there is need to introduce and continuously disseminate practical related courses through the use of these software packages to teach, observe and evaluate students level of adaptation in the process of its applications to boost and increase physics learning interest so that our universities graduate products from the department of physics can move the country state of computer technological software innovations and application to the next level so that we can be part of the flying jets in technology.

Statement of Problem

It is as a course known for its abstract idea and to further make it easy in teaching and learning in an individualized and efficient way there is need to introduce software methodology in teaching and learning which includes scientific visualization, statistical modeling, real time data collection and dynamic modeling software. According to Onomendo et al (2018),continuous use and applications of computer software in design and simulations will go a long way to eradicate technophobia, this will be possible if enough computers with different software installations related to physics are installed with experts in the field to ensure that students at all levels in the department of physics grasp the knowledge applications in different areas. Moreover, it is observed that the existing physics laboratories in schools are only equipped with manual practical equipments along the years of teaching and learning of physics. However, with the trend of modern technologies in other developing and developed countries which have taken the use of software in learning physics in schools and are doing exploits with it, there is need to completely adapt and introduce the use of physics software along side with the existing manual laboratories to eradicate the clumsy and abstract ideal about physics to the students. To continuously investigate the use of software in physics learning for technological advancement to increase the level of technological literacy there is need for providing hardware's such as tablets and common computers, enhancing internet connectivity and implementing program designed to improve computer literacy for both teachers and students. Though From the adaptation and transition of new software skills curricula development and teaching will have a new face off which will encourage continuous investigation and positive improvements on students in use of physics softwares.

Against this backdrop, some research questions were raised

These are:

1. 1.Does physics software applications increase the students interest, quest and self learning?
2. Does continuous use of physics software allow students to identify new innovations in the process of its application?
3. Does continuous use of physics software application enable the students to solve scientific problems in physics?
4. Does continuous application assist students identification and understanding on scientific software command applications?
5. Does the presence of experts in the various aspects of physics soft ware boost its learning and applications?

Objectives of the Study

The broad objective of the study is to investigate the competency of physics students in the use of software in learning physics courses in Ambrose Alli University Ekpoma in the department of Physics. However, to achieve the broad objectives, some specific objectives were set.

The specific objectives is to :

1. To find out if physics software applications increase the students interest, quest and self learning.
2. To find out if continuous use of physics software allows students to identify new innovations in the process of its application.
3. To ascertain if continuous application of scientific software will enable the students to solve scientific problems in physics.
4. To ascertain the level of the students identification and understanding on scientific software command applications.
5. To find out if the presence of experts in the various aspects of physics soft ware will boost its learning and applications.

Research Hypothesis

The following research hypothesis were formulated by the researcher and will be tested at 0.05 level of significance.

1. There is a significant difference in physics software application in increase of students interest, quest and self learning.
1. There is a significant difference on the continuous use of physics software by students to identify new innovations in the process of its application.
2. There is a significant difference on the students using scientific software to solve scientific problems
3. There is a significant difference on the students identification and application of scientific software command in solving scientific problems.
4. There is a significant difference in the presence of experts in the various aspects of physics software in boosting its learning and applications.

Significance of the study

There are sequence of significance both to individual and society at large. However, the significance is targeted both at the teachers and the students, this will be a reality that students are well grounded in the use of software in different areas or aspects of physics. Findings on this research will go a long way to assist the trainer and the trainee in the process of learning and teaching so as to cultivate in individual the spirit of learning software applications so to increase the number of prospective scientist and technologist for a national development and a dynamic economy and prior to scientific and technological innovations by both students and teachers in solving complex problem and display of digrams.

Scope of the study

This study focuses on the Investigation of the competency of physics students in the use of scientific software in studying physics as a course in the department of physics faculty of physical sciences Ambrose Alli University Edo State.

II. Methodology

Design of the study

It is an experimental design that requires individual to be studied and randomly assign to the experimental and control groups. The experimentation will involve direct contact with the population/sample that had same characteristics, qualities or attributes which are relevant to specific observation. The researcher will adopt the pretest and posttest design to collect and analyze the **investigation of competency of physics students in the use of scientific software in studying physics courses in Ambrose Alli University.**

Population of the study

The population will consist of a total number of students in 300 and 400 level the department of physics, geophysics and curriculum &Instruction in the university.. Forty students (40) were randomly selected from each from the three (3)departments that study physics that is physics, geophysics and physics education to a total number of one hundred and twenty(120).

Sample and Sampling Technique

The sample of the study will be made up of one hundred twenty (120) students. The sample size that will be used for the study is 50% of the population of students a stratified sampling technique will be used such that the entire student will be divided into two groups. The One hundred and twenty students will be divided into two groups that is experimental and control group.

The learning process should provide an opportunity for learners to acquire knowledge itself in accordance with the prior knowledge they already had, which is the result of interaction with the environment. Such learning process is to verify the students level of acquaintance to the use of software in writing program or to run a design.

The research subjects were 120 students which will be pretested before they will undergo treatment and will be post tested as the experimental group and 120 students for the control group. The experimental group in this research is the group that was taught by the use of software (student-centered) by experts after been pretested without the prior knowledge on the use of these scientific software.

Research Instrument

The instrument for the collection of data will be Achievement Test in physics software application (ATPSA).The test will contain ten (10) questions five of which is allocated to each software application i.e(Math Lab and HFSS) . The research question will be answered using mean standard deviation Test re- test technique will be adopted to determine the reliability co-efficient of instrument.

A co-efficient value of 0.05 and above will be considered high enough for the instrument.

Administration of Instrument

The researcher visited the school selected the numbers of the sampled students with the cooperation of the head of department and lecturers to administer the copies of the questions to the students who study physics in the department. for the study in the university. To enhance productivity the researcher employed the service of five (5) research assistants who also have the knowledge of physics software application to facilitate the administering and retrieving through printing of students responses.

Method of Data Analysis

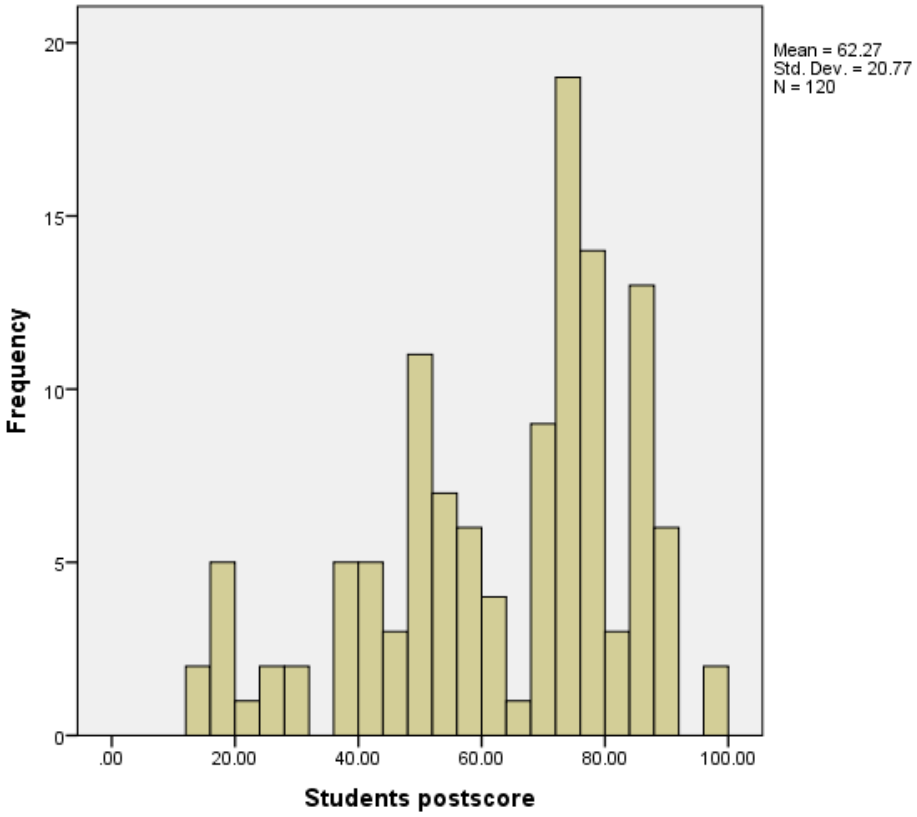
An analysis techniques in form of t-test used to determine differences in the pre-test and post-test on the experimental and control groups at alpha level of 0.05.

III. Results and Discussion

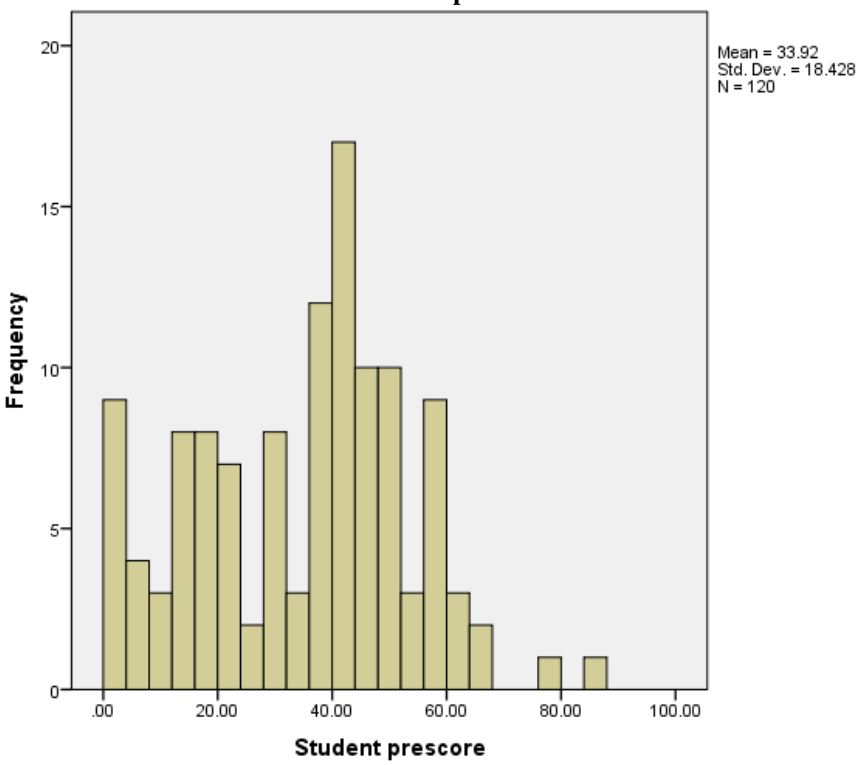
Table 4.3 Paired Samples Test

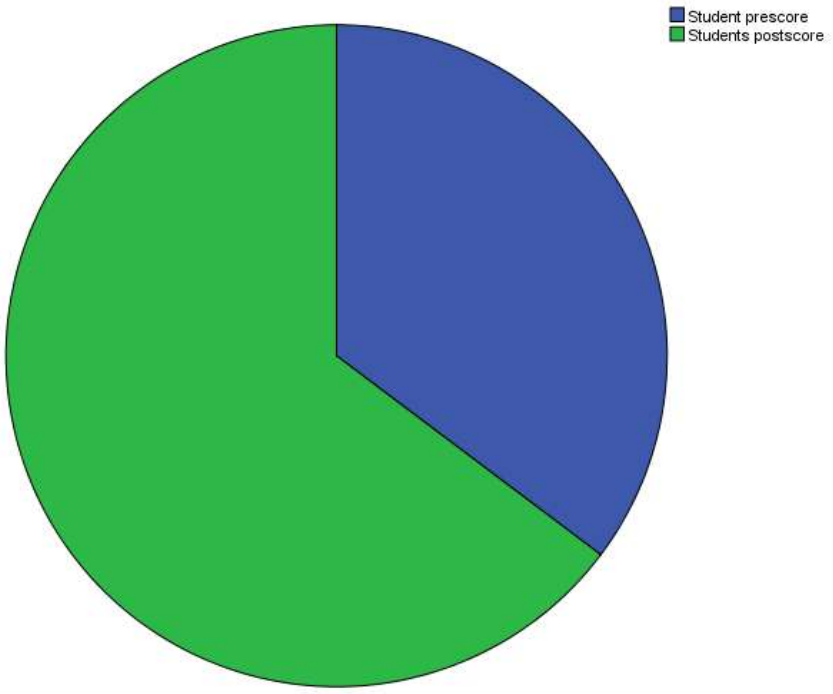
		Paired Differences					T	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Student prescore - Students postscore	-28.35000	14.90059	1.36023	-31.04340	-25.65660	-20.842	119	.000

Graph 4.1



Graph 4.2





Chat.1

From table 4.4 it is observed that 33.92 for pretest and 62.27 for post test, standard deviation of 18.43 and 20.77 and table 4.5 on paired differences of mean 28.35 and a standard deviation of 14.90 a standard error of 1.36, a **T** value of -20.84 and significance value of .000 which is below the alpha level of 0.05.From the various value, the T-value shows that there is a significant difference between the pretest and the post tested students in physics software applications that is it increases students interest, quest and self learning. Graph 4.1 and 4.2 shows a clear significant difference on the use and application of scientific software.

Hypothesis 2: There is a significant difference on the continuous use of physics software by students to identify new innovations in the process of its application

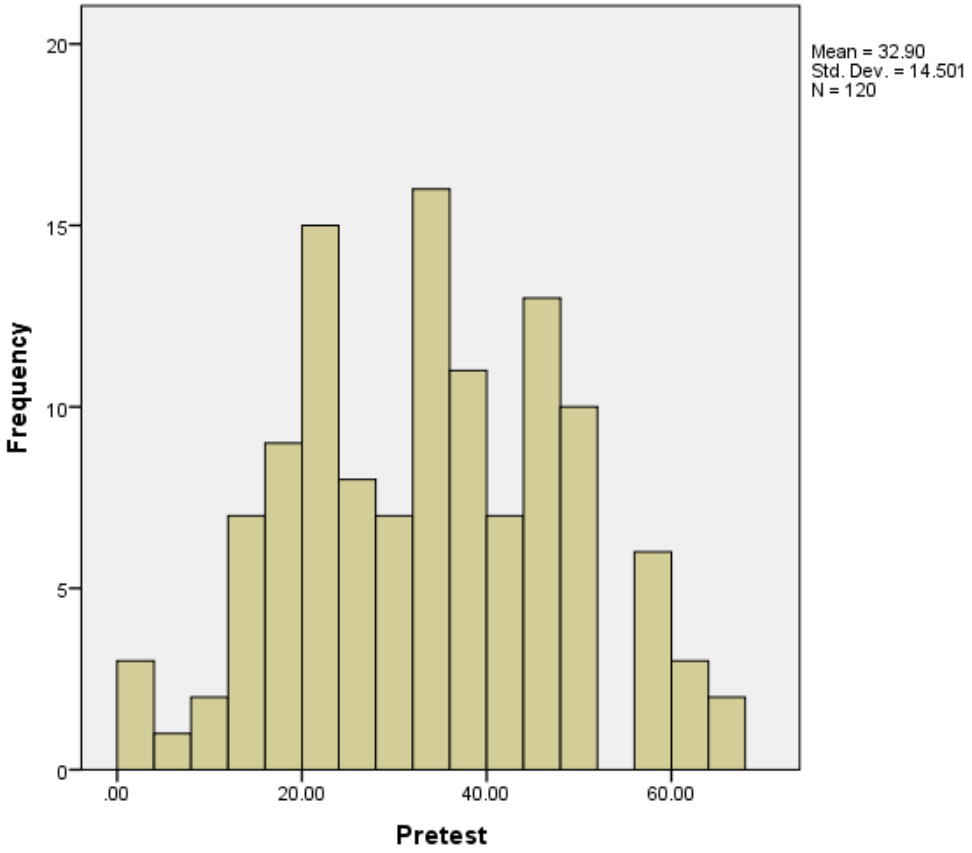
Table 4.5 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	32.9000	120	14.50088	1.32374
	Postest	72.7667	120	13.62939	1.24419

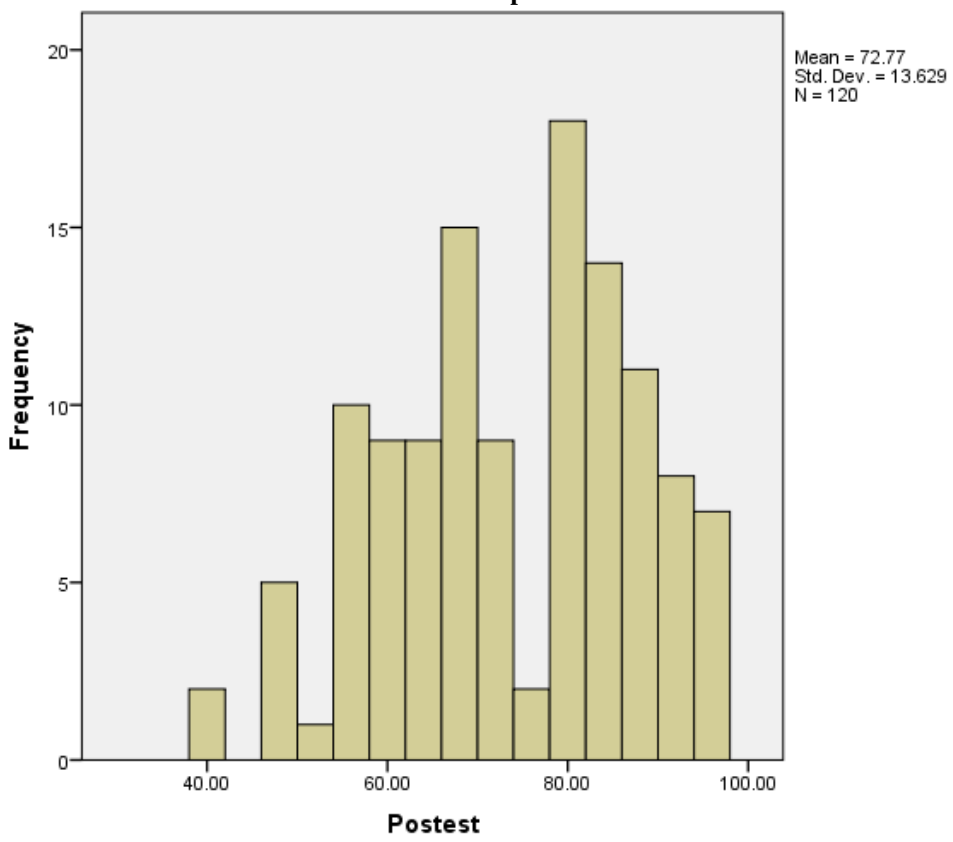
Table 4.7 Paired Samples Test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest – Postest	-39.86667	17.01948	1.55366	-42.94307	-36.79027	-25.660	119	.000

Graph 3



Graph 4.



From table 4.5 the result response to hypothesis two shows that the pretest mean and posttest mean have a value of 32.90 and 72 .77 with a **T** value of -25.67 and a significant value of 0.000.The paired mean differences from the table reading -39.87 and a standard deviation of 17.02, this show there is a significant different on the students on the continuous use of scientific software in innovating processes by the students compared to when they do not have the prior knowledge. The graph also for the post test and pretest shows clearly students with their pre knowledge before they were thought majority scored above 70% and pretest majority scored below 40%.

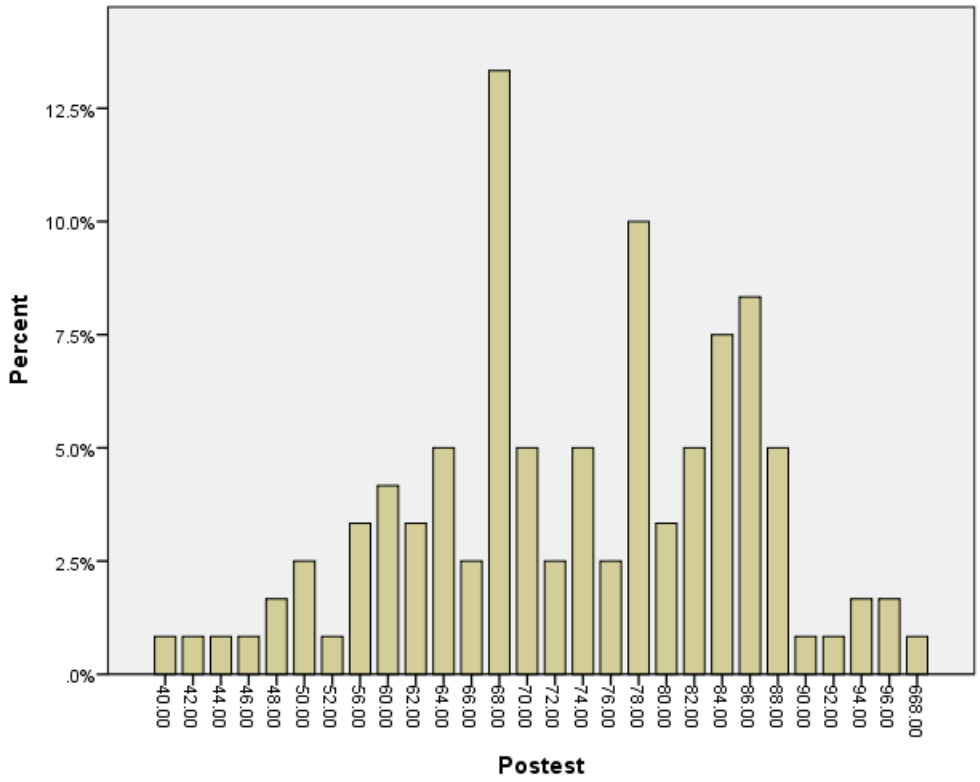
Hypothesis 3: There is a significant difference on the students using scientific software to solve physics scientific problems

Table 4.8 Paired Samples Statistics

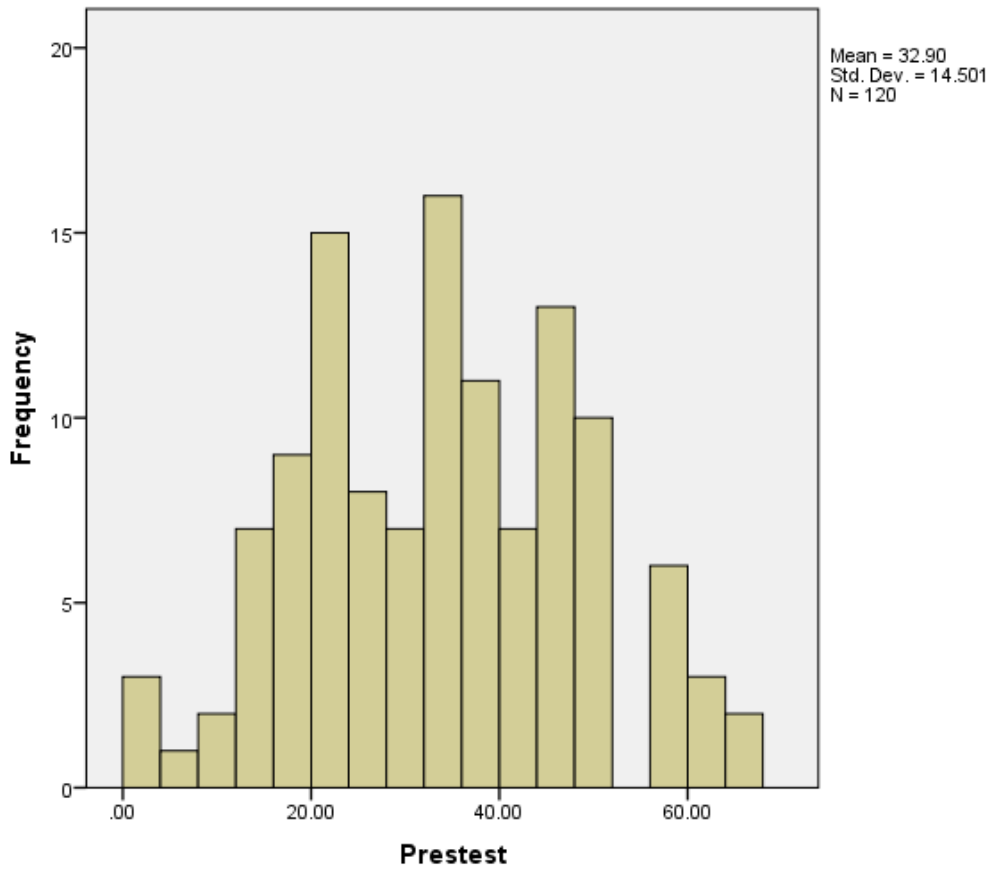
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Prestest	32.9000	120	14.50088	1.32374
	Postest	77.8500	120	55.71606	5.08616

Table 4.10 Paired Samples Test

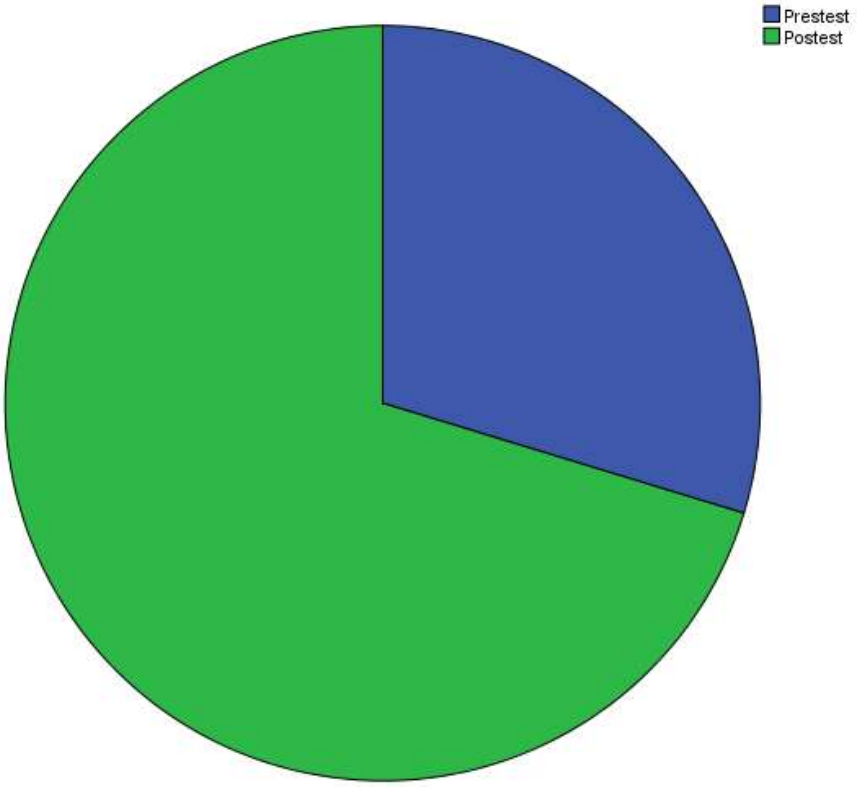
	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Prestest - Postest	-44.95000	54.79923	5.00246	-54.85537	-35.04463	-8.986	119	.000



Graph.5



Graph 6.



Chat.2

The result response to hypothesis three from table 4.8 shows for pretest and posttest with a mean value of 32.900 and 77.85 having a paired differences of mean 44.95 standard deviation of 54.80 and a **T** value of -8.99, a significant value of 0.000, which is far lower than the alpha level of 0.05.This shows that there is a high significant difference on continuous use of physics software that is; the students using scientific software to solve physics scientific problems and has assisted to eradicates technophobia and cyber phobia among physics students. The posttest and the pretest graph and the pie chart diagram explicitly display a significant difference on the students on using scientific software to solve physics scientific problems.

Hypothesis 4: There is a significant difference on the students identification and application of scientific software command in solving scientific problems.

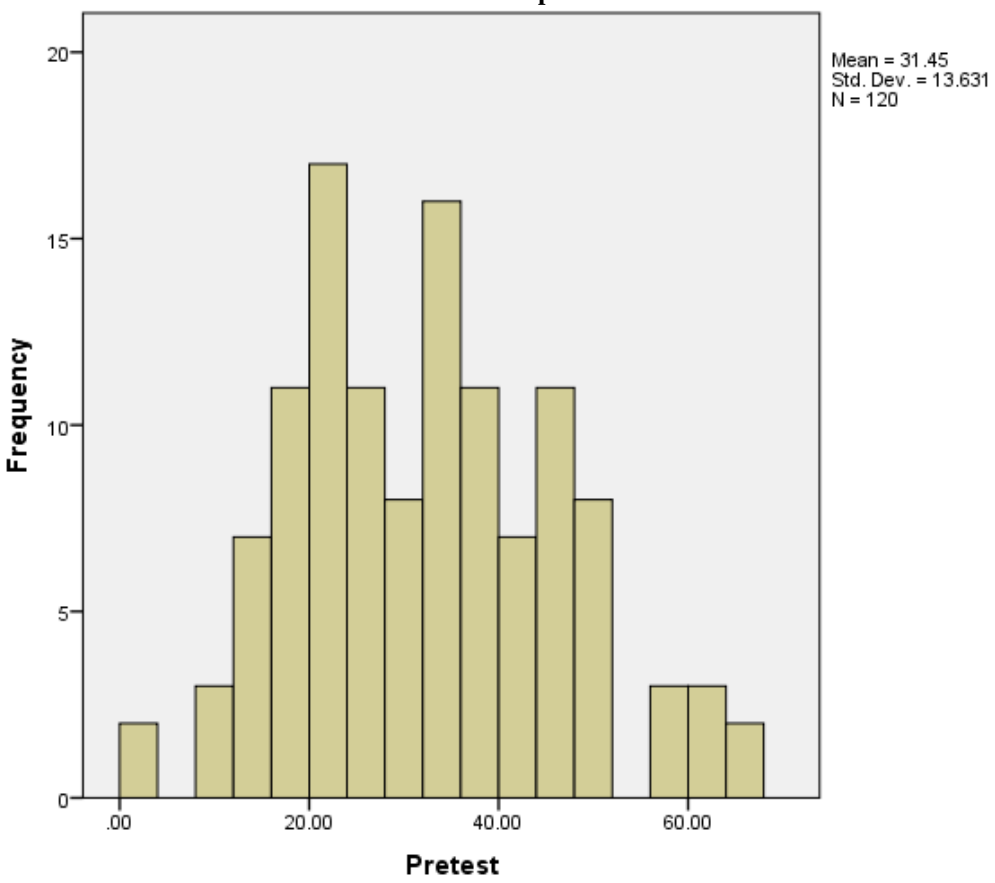
Table 4.11 Paired Samples Statistics

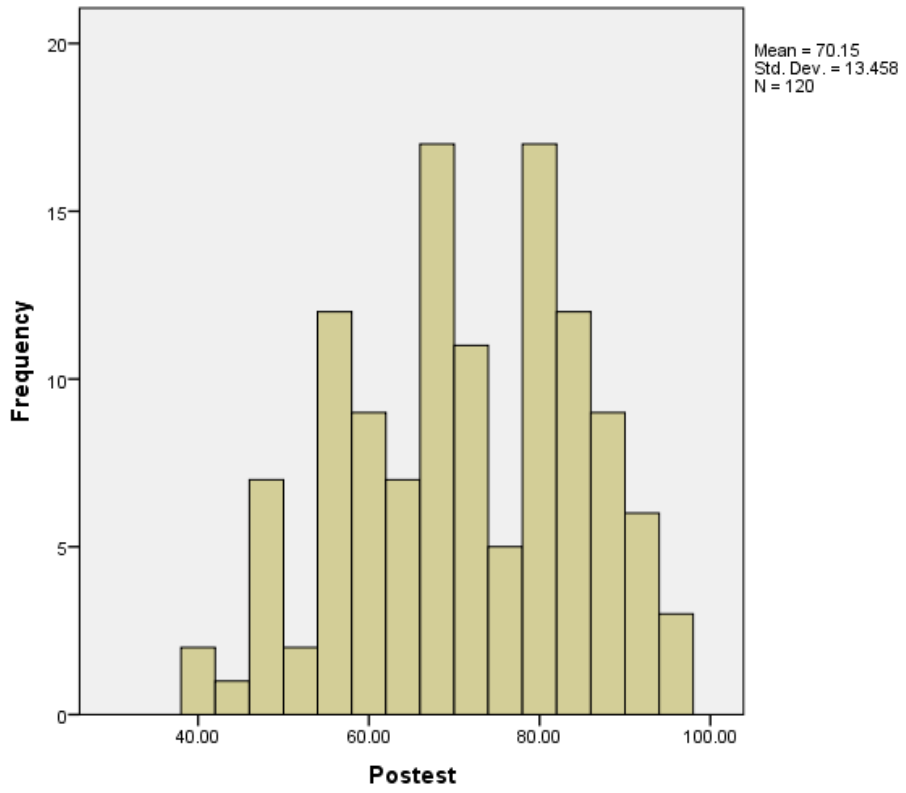
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	31.4500	120	13.63131	1.24436
	Postest	70.1500	120	13.45809	1.22855

Table 4.13 Paired Samples Test

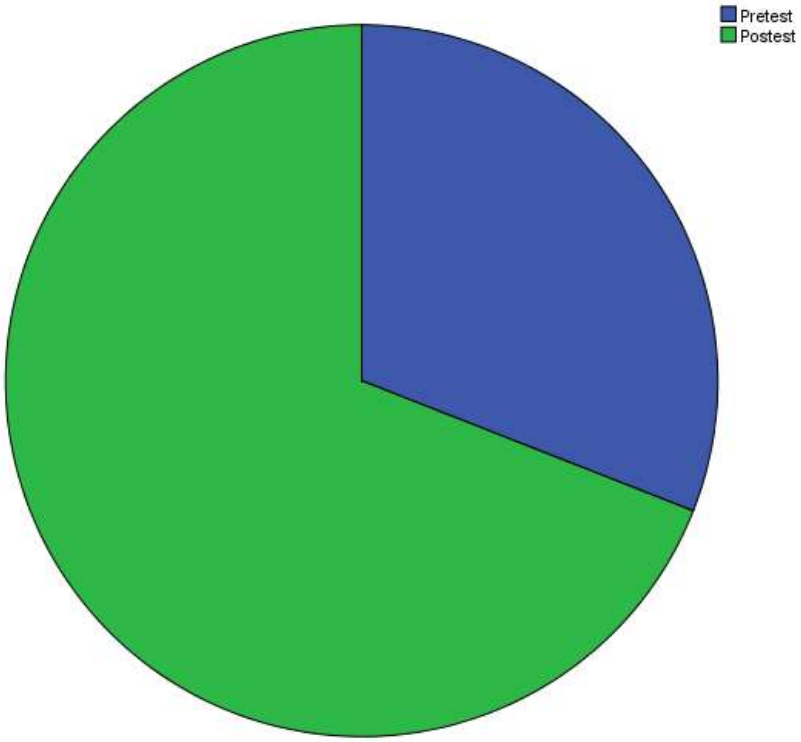
		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest - Postest	-38.70000	14.77597	1.34886	-41.37087	-36.02913	-28.691	119	.000

Graph.6





Graph.7



Chat.3

From table 4.12 and 4.13 result response to research hypothesis Four (4) shows that the pretest and post test have a mean value of 31.45 and 70.15 having a paired differences of mean 38.70, standard deviation 14.78, standard deviation error of 1.33, a **t** value of -28.69 and a significant value of .000 which is far below the alpha level of 0.05.These figures shows a significant difference exist on the level of the students identification and application of scientific software command in solving scientific problems. Students who participated in the exercise observed that they were able identify and apply some command in the scientific software The graph for pretest, post test and the pie chart shows the difference on the students performance before and after.

Hypothesis 5: There is a significant difference in the presence of experts in the various aspects of physics software in boosting its learning and applications.

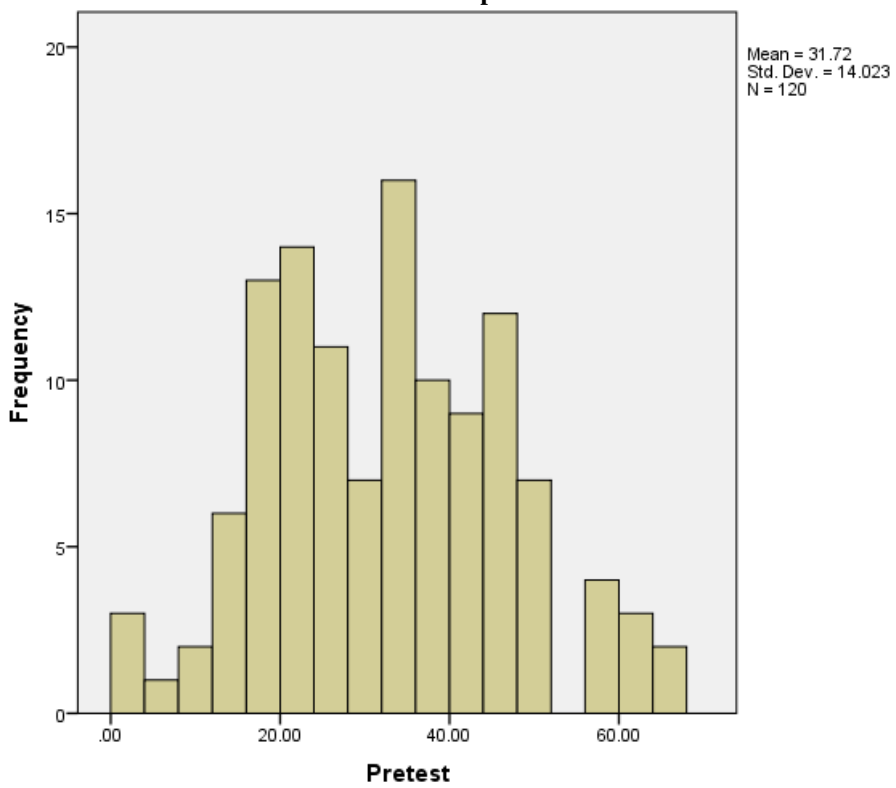
Table 4.14 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	31.7167	120	14.02350	1.28016
	Postest	72.7167	120	12.35006	1.12740

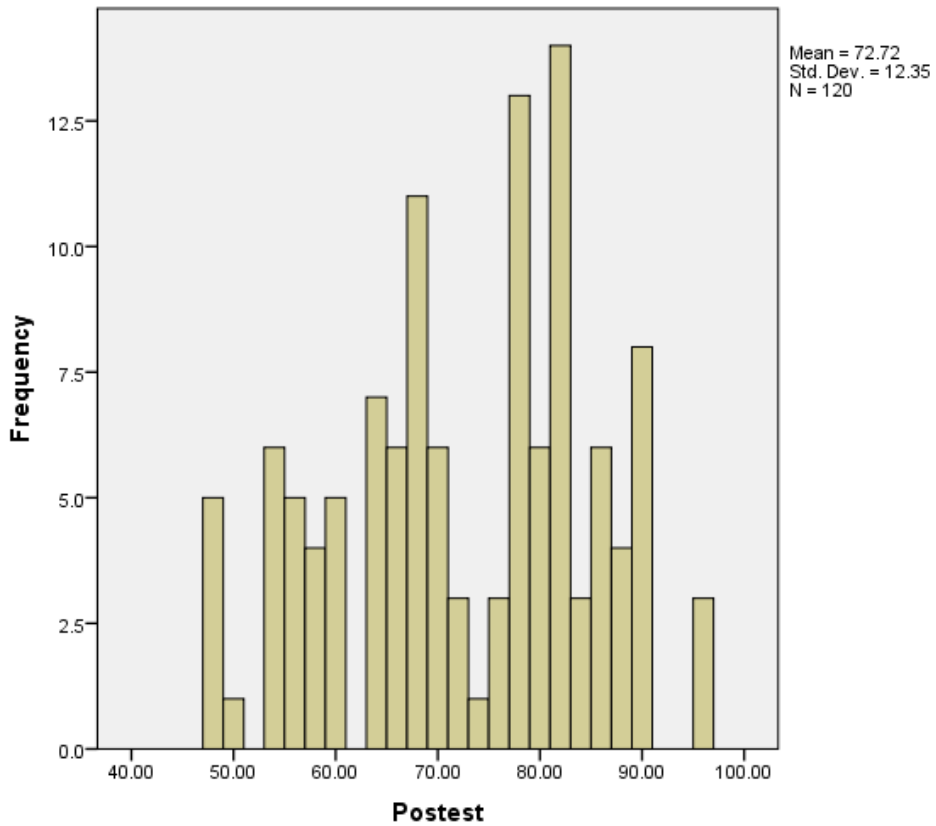
Table 4.16 Paired Samples Test

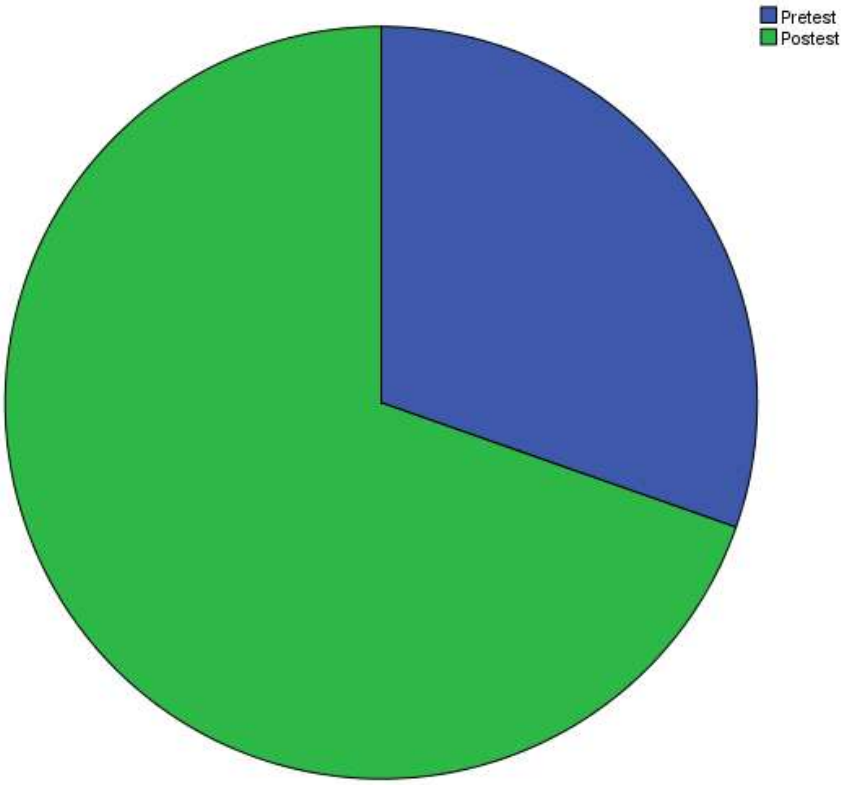
	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pretest - Postest	-41.00000	16.83733	1.53703	-44.04348	-37.95652	-26.675	119	.000

Graph 8.



Graph 9.





Chat.4

From table 4.16 and 4.15 the result response to hypothesis(**5**) five shows that the pretest mean and posttest mean have a value of 31.72 and 72 .72 standard deviation of14.02& 12.35 with a **T** value of -26.68 and a significant value of 0.000 which is below alpha level of 0.05 which shows highly significant difference. The paired mean differences from the table reading 41.00 and a standard deviation of 16.84, standard error of 1.54. The graph also for the post test and pretest shows clearly students with expert's presence before they were thought majority scored above 80% and pretest majority scored below 40%. These figures explicitly show there is a significant difference in the presence of experts in the various aspects of physics software in boosting its learning and applications with the students compared to when they were not present.

IV. Discussion

Scientific software plays an important role in processes related data collection, management, formatting, analyzing and visualizing. Rapid development of data enhanced methodologies in the world of science has led researchers to rely increasingly on information technology. It is impossible to access, analyze and visualize some large data set without support of dedicated software(Goble,2014). Scientist believes in the application of scientific software in the field of research studies. (Hannay et al., Hetrick, 2009;2014), Observed results investigations of researchers that 70% 0f 417 researchers From 15 Russell group universities (United Kingdom) that 91% of scientist believe on the importance of software.

Nowadays it is obvious that software programs have a profound influence on academic research. Findings from this study exhumed that the use of scientific software in studying Physics as a course studied at the university level in higher institutions has assisted to erase it's abstract idea and to further make it easy in teaching and learning in an individualized and efficient way which has helped the student to observe scientific visualization, statistical modeling, real time data collection and dynamic modeling software.

From table 4.4 it is observed that 33.92 for pretest and 62.27 for post test, standard deviation of 18.43 and 20.77 and table 4.5 on paired differences of mean 28.35 and a standard deviation of 14.90 a standard error of 1.36, a **T** value of -20.84 and significance value of .000 which is below the alpha level of 0.05.From the various value, the T-value shows that there is a significant difference between the pretest and the post tested students in physics software applications that is it increases students interest, quest and self learning. Graph 4.1 and 4.2 shows a clear significant difference on the use and application of scientific software. This is a veracity of (Stoica,2008) that he use of computers in learning offers the powers to perform computation that is very long and also have graphic capabilities that make them useful in designing devices and simulation of complicated process and also verify (Cortini,1992),Who deduce that the innovations of scientific software's is to

eradicate abstract idea about physics and boast their interest for effective knowledge acquisition. Moreover, Tüysüz (2010), opined that the computer-based media use in laboratory activities can increase student's interest in learning in the classroom and also help them to improve learning outcomes. Laboratory activities are essential in physics learning.

From table 4.5 the result response to hypothesis two shows that the pretest mean and posttest mean have a value of 32.90 and 72 .77 with a **T** value of -25.67 and a significant value of 0.000 which is far less than 0.05.The paired mean differences from the table reading -39.87 and a standard deviation of 17.02, this show there is a significant different on the students on the continuous use of scientific software in innovating processes by the students compared to when they do not have the prior knowledge. The graph also for the post test and pretest shows clearly students with their pre knowledge before they were thought majority scored above 70% and pretest majority scored below 40%. These figures and the graph above states clearly that there is a significant difference on the continuous use of physics software by students to identify new innovations in the process of its application. This clarifies Vagner, (1998) who concluded that different aspects of physics have their various software packages designed for them to enable the collection and analysis of experimental data for new physics pedagogy. This also fulfilled the NPE (2014), establishment of network educational service centres (NESCN) set up to provide a forum of exchange of ideas for development and use of innovative materials for improvement of education.

The result response to hypothesis three(3) from table 4.8, shows for pretest and posttest with a mean value of 32.900 and 77.85 having a paired differences of mean 44.95 standard deviation of 54.80 and a **T** value of -8.99, a significant value of 0.000, which is far lower than the alpha level of 0.05.This shows that there is a high significant difference on continuous use of physics software that is; the students using scientific software to solve physics scientific problems and has assisted to eradicates technophobia and cyber phobia among physics students. The posttest and the pretest graph and the pie chart diagram explicitly display a significant difference on the students on using scientific software to solve physics scientific problems. Result from this hypothesis buttress Krisnant (2010), that the advantages of using simulation software in conjunction with classroom teaching are well known and it is generally acceptable as an interactive teaching tools, which provide instant feedback to the student's inputs, improve and accelerate the learning process.

From table 4.12 and 4.13 result response to research hypothesis Four (4) shows that the pretest and post test have a mean value of 31.45 and 70.15 having a paired differences of mean 38.70, standard deviation 14.78, standard deviation error of 1.33, a **t** value of -28.69 and a significant value of .000 which is far below the alpha level of 0.05.These figures shows a significant difference exist on the level of the students identification and application of scientific software command in solving scientific problems. Students who participated in the exercise observed that they were able identify and apply some command in the scientific software The graph for pretest, post test and the pie chart shows the difference on the students performance before and after. This also confirmed Li (2013), that the broad use of digital technology during the last decades has changed the ways of learning. Also in line with the results of Gunawan et al., (2018),which states that simulation ,visualization of result analysis by students in teaching and learning through the use of scientific software application leaves a pictorial memory on the students.

Finally From table 4.16 and 4.15 the result response to hypothesis(**5**) five shows that the pretest mean and posttest mean have a value of 31.72 and 72 .72 standard deviation of14.02& 12.35 with a **T** value of -26.68 and a significant value of 0.000 which is below alpha level of 0.05 which shows highly significant difference. The paired mean differences from the table reading 41.00 and a standard deviation of 16.84, standard error of 1.54. The graph also for the post test and pretest shows clearly students with expert's presence before they were thought majority scored above 80% and pretest majority scored below 40%. These figures explicitly show there is a significant difference in the presence of experts in the various aspects of physics software in boosting its learning and applications with the students compared to when they were not present.

This result on this hypothesis verify Jufriet et al (2012), stated that the activities of physics experiments that are not supported by good facilities and infrastructure could have a negative impact on student learning outcomes. Suranti (2016), in his studies concluded that teachers as facilitators must be able to present the appropriate learning media to facilitate them to visualize abstract physics concepts to make a difference.

V. Summary, Conclusion, Recommendation and Suggestion for Further Studies

Summary

This research was design to investigate the use of scientific software in teaching and learning of physics among the undergraduate students in the university education system.. From the research findings it is observed that scientific software could be adopted in schools as part of method of teaching and learning in schools and installation of computers in laboratory with different scientific software. For a proper survey of this study the following hypothesis were raised for the study to be guided:

1. .There is a significant difference in physics software application in increase of students interest, quest and self learning.
2. .There is a significant difference on the continuous use of physics software by students to identify new innovations in the process of its application.
3. There is a significant difference on the students using scientific software to solve scientific problems
4. There is a significant difference on the students identification and application of scientific software command in solving scientific problems.
5. There is a significant difference in the presence of experts in the various aspects of physics software in boosting its learning and applications.

Conclusion

In the course of this study, it was discovered that there is a difference between physics students pre knowledge and the post knowledge on the use of scientific software in solving scientific problems and identification of some command used in these software. Moreover there is need for continuous application of scientific software presence of experts increase learners visualization in learning because it eradicates the abstract idea about physics by the students.

Recommendation

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

1. It can be seen that Physics learning requires the use of scientific software to bring in motivation and also increasing their learning spate since software display visualization through design and simulations.
2. Students should have different scientific software with digital laboratory equipped with modern facilities for independency with faster connectivity for optimum learning for scientific modeling and innovations.
3. Workshops and conferences should be organized with experts in various scientific software application.
4. Software application in physics should be designed as part of the curriculum learning.

Suggestion for Further Studies

1. It is a candid suggestion from the researcher that this study should be replicated in other universities with a larger sample to give room for generalization.
2. Scientific software application for learning and teaching should also be investigated in other field of science subject to also ascertain students' performance**.**
3. Other software should be tested for subsequent research since SPSS, MATLAB and HFSS were used relating to this study.

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