Effect of E-Learning Approach on Academic Performance of Students in Computer Science Department, Nuhu Bamalli Polytechnic, Zaria, Nigeria

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ABSTRACT
The study sought to examine the effect of e-learning approach on academic performance and retention ability of students in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science Department. Quasi Experimental research design was used to gather data for the study. The study was guided by two research questions and two null hypotheses. The population of the study is made up of all the students of computer Science from the School of Applied Science of Nuhu Bamalli Polytechnic Zaria which added up to 1000. The Krejcie and Morgan table was used to determine the sample size. Consequently, a sample size of 278 was chosen and this were randomly selected among the students. The students test scores in their academic performance as well as retention were recorded before and after exposure to e-learning using ICT facilities. The data was analyzed using both descriptive and Inferential (t-test) statistics of SPSS version 26. The results as analyzed indicated that the students mean performances has greatly increased from 27.45 to 80.46 among the experimental group exposed to ICT Moodle as compared with the control group. $P < 0.05$, t computed > t critical; at df 276. The retention ability has greatly increased from 30.05 to 65.05 among the experimental group exposed to ICT Moodle as compared with the control group $P < 0.05$, t-computed > t critical; at df 276. The study's conclusion is that ICT Moodle have significant effect in improving the academic performance and even the retention abilities of the students in the School of Applied Science, Nuhu Bamalli Polytechnic, Zaria.

Keywords: E-learning Moodle, Students' Performance, Retention Ability and Nuhu Bamalli Polytechnic

INTRODUCTION
Information and Communication Technologies (ICT) provide new opportunities for education and training, as they enhance learning and teaching, and facilitate collaborations, innovation and creativity for individuals and organizations (Ala-Mutka, Punie & Redecker, 2008). Although often used as an extension of other teaching tools, the use of ICT has the potential to open opportunities of new ways of doing things, thus developing creativity in learning. Furthermore, ICT use has been found to be associated with creativity. Thus, the use ICT can support development of public policy for educational change that promote creative and innovative school and Tertiary Institution environment (Cachia, Ferrari & Punie, 2011).

In higher education application of ICTs in the form of e-learning is already changing teaching and learning processes. Due to the rapid growth of Internet Technology, Tertiary Institutions around the world are investing heavily in e-learning systems to support their traditional teaching and to improve their students' learning experience and performance (Abbasi, M. S., Elyas, T., & Shah, F. (2015).

Moodle is a software package for producing internet-based courses and websites. It is a Learning Management System (LMS) that allows better cooperation among learners, tutors and students (Terherst and Adrienne, 2013).

Learning is the process in which people get information to enhance their knowledge for improving their performance (Rosenberg, 2013).

E-Learning is the use of technology to enable people to learn anytime and anywhere. E-Learning can include training, the delivery of just-in-time information and guidance from experts. It has become increasingly popular learning approach in higher educational institutions due to the rapid growth of internet technologies (Mahmud &Gope, 2012).

The purpose of this research was to investigate the effect of ICT Approach versus that of traditional classroom learning, on student learning, based on learning materials deployed. Another goal was to determine effect of ICT approach on the students' retention ability in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department. The research adopted Pre-test-Post-test control group design, this is to compares outcomes for one group of individuals' before and after the group's involvement in a program. Quasi-experimental designs identify a comparison group that is as similar as possible to the treatment group in terms of baseline (pre-intervention) characteristics.

The research is restricted to Nuhu Bamalli Polytechnic which has very large population of students in various (8) schools, which serves as our universe population, but our target students' population is that of the School of Applied Science (SAS) that has three departments (Computer Science (1000), Science Laboratory Technology (1141) and Statistics (194)) with a total student population of **2335** (NUBAICT,2019). But our study population is computer science with a total of 1000 student population out of which **785** are male students and **215** are female students respectively.

The development of telecommunications technology and personal computers provides what is considered to be the general timeline of e-learning. The timeframe of greatest development in this area is thus within the last forty years. Globalization is focused on e-learning because e-learning technology has the potential to bring improved learning opportunities to a larger audience than has ever previously been possible.

E-LEARNING TECHNIQUES FOR MOODLE LEARNING SYSTEM

Some of the widely used eLearning techniques for Moodle learning methods includes

- **Web eLearning:** Web eLearning is based on website content.
- **Virtual Classrooms:** this is an online system of learning that allows students and Lecturers communicate and collaborates.
- **Mobile learning:** This is a learning process via network using personal devices, such as tablets and smartphones to obtain learning materials through mobile apps, social interactions and online educational hubs. It is flexible, allowing students access to education anywhere, anytime.
- **Video Modules:** this are professional development resources that include skill videos and reflection questions.
- **Specialized eLearning:** This provides a unique ability for creating individual client portals for different clients or groups. This enables clients to access their very

own branded online training which is in line with their own level of learning.

- **Social Media Training:** this is a computer- based technology training that facilitates the sharing of ideas, thoughts and information by interacting with others through virtual networks and communities, directing traffic to your website, and mostly having a conversation in a way that is engaging.
- **Microlearning:** this is an educational strategy that breaks complex topics down into short-forms, stand-alone units of study that can be viewed as many times as necessary, whenever and wherever the learner has the need.

But in our research, we used the **Mobile learning**technique **(90%)**, this is because almost all the Control Group students have and can use their Smartphones or Tablets or Androids for accessing the Moodle materials by using the username and password giving to each participant. We also used the **Virtual Classroom** technique **(10%)** due to poor network experienced by the participants.

JUSTIFICATION FOR USING HIGH CONTROL NUMBER FOR EXPERIMENT

An experimental group is composed of participants that receives the variable being tested in an experiment. The control group is composed of participants who do not receive the experimental treatment. In our research we have assigned the students into these two groups. But thestudents were randomly assigned to be in these two different groups based on equal chances. Ideally, the control group and the experimental groups are identical in every way except that the experimental groups are subjected to treatments or interventions believed to have an effect on the outcome of research interest while the control group is not. But inclusion of a control group greatly strengthens our ability to draw conclusions from the research. Indeed, with the presence of a control group we were able to determine whether a treatment we investigated truly has a significant effect on an experimental group, and we decided to use high control number for experiment to help us in reducing making an erroneous conclusion.

OBJECTIVES OF THE STUDY

The main objective of this study is to investigate the Effect of ICT Approach on the students' Academic Performance through the use of Designed E-Learning Moodle. The specific objectives are:

(1) Investigate the effect of ICT approach on Polytechnic Students' performance in Moodle E-Learning system and those taught with lecture Method in the department.

(2) Find out the Effect of ICT Approach on Polytechnic student's retention ability in Moodle E-Learning and those taught with Lecture Method in the department.

RESEARCH QUESTIONS

The following research questions are to be answered in the course of this study.

1) What is the Effect of ICT approach on Polytechnic Students' performance in Moodle E-Learning system and those taught with lecture Method in the department?
2) What is the effect of ICT approach on Polytechnic students' retention ability in Moodle E-Learning and those taught with Lecture Method in the department?

RESEARCH HYPOTHESES

The following null research hypotheses are to be tested at0.05 alpha level of significance.

(1) There is no significant difference on the effect of ICT approach on Polytechnic Students' performance in and those taught with lecture Method in the department.
(2) There is no significant difference on the effect of ICT approach on Polytechnic Students' retention ability and those taught with lecture Method in the department.

LITERATURE REVIEW

E-learning is defined as a system based on technology, organization, and management which bestows upon the students the ability to learn via internet and facilitates their learning (Levy, 2006). E-learning makes use of telecommunications technology to get information to achieve the teaching and learning objectives (Bowles, 2000). Also Wanting *et al*. (2000) define e-learning as acquisition of the disseminated knowledge using electronic devices. it can be said that e-learning refers to the use of systems of electronic education such as computer, internet, multimedia disks, electronic magazines, virtual newscasts, and etc. whose purposes are to reduce time and expenses and achieve better, faster, and easier learning (Zare *et al*, 2014). Employment of information and communication technologies in education has created a new mode of learning which does not require physical attendance; hence, learning has been made possible in environments other than classrooms (Gholamhosseini, 2008). In this context, some study is reviewed next.

Many researchers in their findings concluded that e-learning has a positive impact on academic performance of students. Zarei-Zavaraki, E. & Rezaei, I. (2011) in their study at the e-learning center in Khaje Nasir Toosi University in their conclusions, found that the use of e-portfolio significantly improved students' attitude, motivation, retentions and academic achievement. Zare *et al*. (2015), found that learning and recollection of students who were educated to multimedia methods, is more than learning and recollection of students who were educated in the traditional methods.

Review of studies conducted in the field of e-learning application and its impact on learning and creativity suggests that the use of this teaching method in the teaching-learning process can lead to the effectiveness of training. Emergence of new theories of teaching and learning has made the education to shift from being teacher-oriented to being student-oriented. Moreover, development and evolution of new communication devices has enabled modern man to use modern methods of teaching and learning and get free from time and space barriers and keep on learning in any time and place according to his needs and demands (Hosseini *et al*., 2015).

The importance of this alternate learning system in Nigeria cannot be over-emphasized, especially in the face of this COVID-19 pandemic. E-learning outfits make it easier for teachers, institutions, and students to strategize, provide, and monitor the knowledge and instruction method (Almaiah, M. A, 2020). The use of electronic technologies has led to the development of educational opportunities and helps students develop their skills. According to studies, the evidence shows that e-learning can have a profound and positive impact on learners' involvement, positive attitudes of teachers, personalized learning, and learners' creativity (Magnoson *et al*., 2010).

The emergence of the COVID-19 pandemic has made some countries, including some states in Nigeria such as Kaduna, Lagos, Oyo, and Ogun, to consider a web-based learning approach. E-learning is no more to be thought of as in future tense; it is here already, and thankfully, as an answer to teaching

problems. Although, a few Nigerian schools, the Kaduna State University and some private universities, such as Base University Abuja in addition to the traditional face-to-face way of learning currently offer e-learning at most levels of post-secondary education. Jegede, in an interview with The Guardian newspaper, has said that the government must give an enormous guarantee and strong strategy toward distance learning in order for education to meet a worldwide standard (Lawal, I., 2020).

With the resources provided by Information and Communication Technologies, E-learning has been employed in multiple Tertiary institutions Nuhu Bamalli Polytechnic inclusive, as well as in wide range of training centres and schools. E-learning exploits Web technology as its basic technical infrastructure to deliver knowledge. As the current trend of COVID-19 pandemic and academic realities, the whole world has witness sudden increase in the use of e-learning, and higher demand of technology support is expected.

According to Ajayi (2013) Information and Communication Technology has helped to change the learning and teaching methods with proper use of computer and computer networks. The traditional way of learning through accessing a classroom physically, is not necessary nowadays in developed countries. Students can learn when they want and from where they want using a computer network. They are not bounded by time and boundary. Information technology not only provides support for the delivery of learning or training materials but also it helps to organize, rearrange, reuse and store the learning materials.

Since e-learning has been an important and ever more frequently used teaching technique in the past decades, there are also many studies on its effect on students' performance. Delivering instructions that can produce equal or even better outcomes than face-to-face learning systems is one of the main goals of introducing ICT into the study process (Saba, 2012). But besides the many advantages of this type of study, there are also many disadvantages which can reduce the positive impact of modern ICT tools on students' performance. Moreover, in the e-learning process there are also many specific factors involved that are not directly connected with ICT but importantly influence the students' performance, sometimes also in a negative way.

Sulčič and Lesjak (2009) claim that, although ICT represents a fundamental material condition for e-learning, it does not have a statistically significant influence on the effectiveness of e-learning. Similarly, Russell (2001) discovered no statistically significant differences between classical and online learning. Different authors report varying attrition rates, e.g. from as high as 70%–80% (Dagger and Wade, 2004, Flood, 2002) to 20%–50% (Frankola, 2001; Diaz, 2002). These attrition rates can even be higher (between 10%–20%) than for traditional face-to-face education (Carr, 2000). When measuring students' performance also with other measures, (Novo-Corti, Varela-Candamio and Ramil-Diaz, 2013) report an increase in the performance of students (grades and qualifications) when using the mixed technology of e-learning in Moodle and face-to-face lectures.

According to Ally (2004), the teaching strategies as well as testing and assessment methods are much more important than the use of ICT in education. Students' non-participation in the learning process plays an important role in high dropout rates in online learning (Dagger and Wade, 2004). It is therefore very important to determine

which approaches might increase student engagement (Tyler-Smith, 2006).

The review of the previous studies raises the dilemma of the validity of such comparisons since the statistics on retention and drop outs can be incomparable, unreliable and/or misleading (Hall, 2001; Haverilla, 2009; Saba, 2012; Wang, Foucar-Szocki, Griffin, 2003). Researchers acknowledge that the reasons for attrition are many and complex and that there are no simple solutions (Berge and Huang, 2004).

The same is true for students' performance, measured as average grades and the average number of admissions to the exams. There are many factors that influence students' performance, such as (Chien, 2012; Haverila and Barkhi, 2009; Kim and Kim, 2013; Saba, 2012; Upadhyaya and Mallik, 2013; Yukselturk and Burut, 2007): learner characteristics (demographic factors, prior e-learning experience, ability and interest, motivation, self-regulation), supporting systems (organizational aspects – e.g. structure and institutional arrangements; people aspects – e.g. motivation, training, other stakeholders) and e-learning system (quality of contents, tasks (instructor factors), technology – e.g. system reliability, user interface).

It can be deduced from the reviewed literature that there is a huge research gap concerning the contributions of socio-demographic factors of students involved in an e-learning system to their academic performance. Nevertheless, a few researchers have focused on selected socio-demographic aspects of e-learning, such as Berge and Huang (2004), Yukselturk (2005) and Park and Choi (2009). In general, however, individual factors (i.e. socio-demographic, e.g. age, gender, education etc.) seem to have little influence on student performance. Indeed, (Willging and Johnson, 2004) claimed that external factors such as family issues, lack of organizational support, and workload are the crucial factors affecting students' performance in an e-learning system (also see Park, 2007). Nevertheless, in our study we tried to fill abovementioned research gap and highlight the importance of a selected socio-demographic background on Computer Science students' performance and retention ability using the designed eLearning Moodle environment in Nuhu Bamalli Polytechnic, Zaria.

METHODOLOGY

This study took the form of a descriptive survey, and sample size of 278 students was randomly selected from among population size of 1000 students from computer science department. The sample size consists of individual from the population chosen in such a way that every set of individual has an equal chance to be the sample activity selected.

A questionnaire titled "Effect of E-Learning Approach on Academic Performance and Retention Ability of Students in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department" designed by the researchers was used to collect the data. The instrument was validated by experts in computer science, educational technology and tests and measurement. To ensure reliability of the instrument the Cronbach alpha statistics technique was employed.

The data collected were analyzed through the use of both descriptive mean statistics and inferential statistics, the descriptive was used to answer the research questions. The inferential statistics of independent t-test statistics was used to test the two null hypotheses at 0.05 alpha level of significance. The Statistical Package that was used is the Statistical Packagefor Social Sciences (SPSS) version 26.

RESULTS

TABLE 1: Presentation of Bio data variables

Variable	Percentage
Study groups:	
Experimental	50.4
Control	49.6
Total	100.0
Study level	
ND1	29.1
ND2	25.5
HND1	23.4
HND2	21.9
Total	100.0
Accommodation status:	
On campus	57.9
Off campus	42.1
Total	100
Gender:	
Male	53.6
Female	46.4
Total	100

The students were classified into two study groups. The first are Experimental Group consist of 50.4% of the students while the second group consist of 49.6% of the students that are in the Control Group.

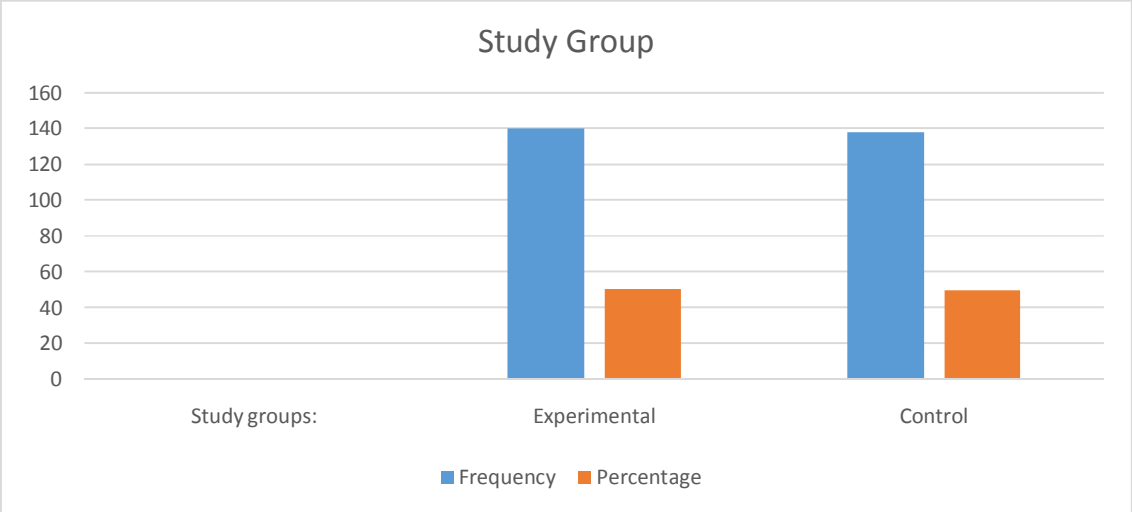

Figure 1: Study Groups

On their Study Level ND1 students had 29.1% while ND2 had 25.5% as against HND1 that had 23.4% and the rest 21.9% are HND2 students of the department.

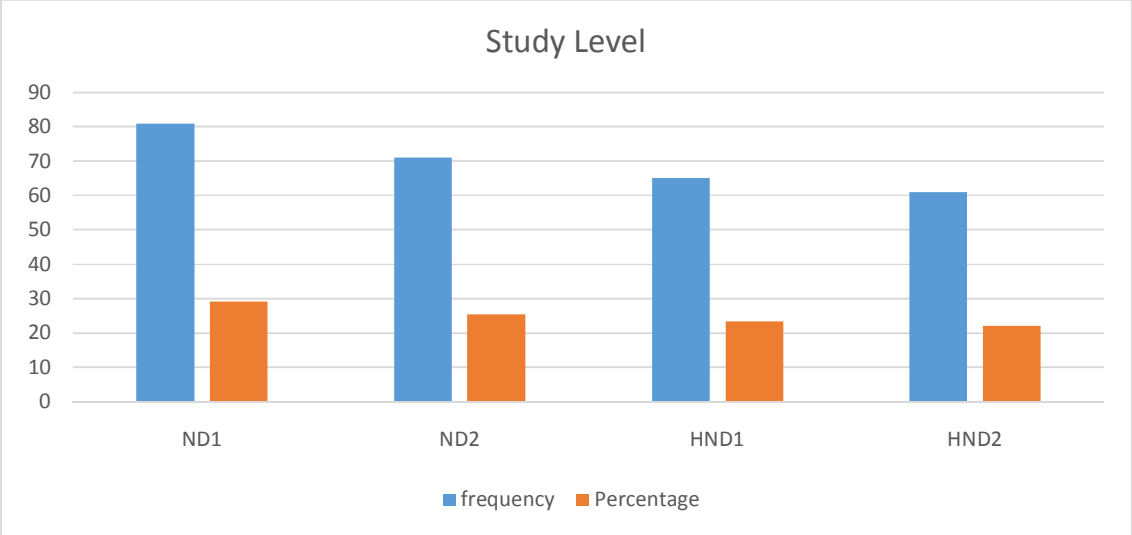

Figure 2: Study Level

On **Accommodation Status,** 57.9% are living on campus while the rest 42.1% are off campus students.

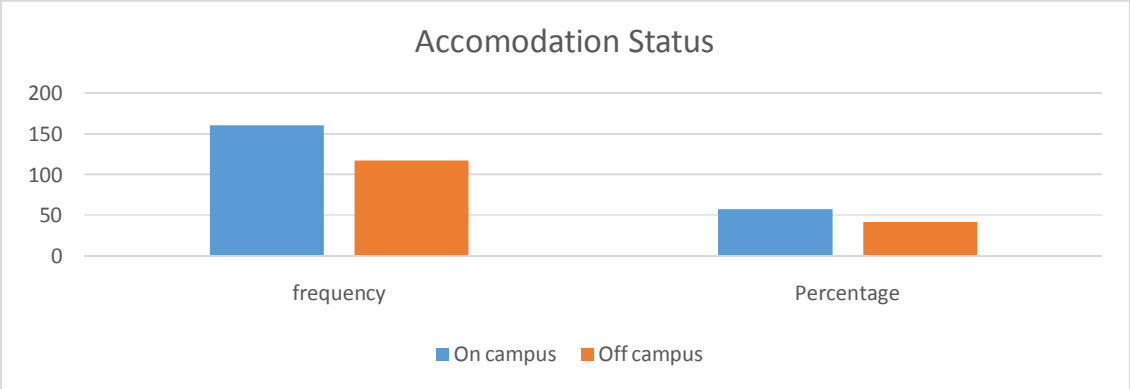

Figure 3: Accommodation Status

On **Gender Status**, a total of 149 or 53.6% are male and the rest 129 or 46.4% are female students.

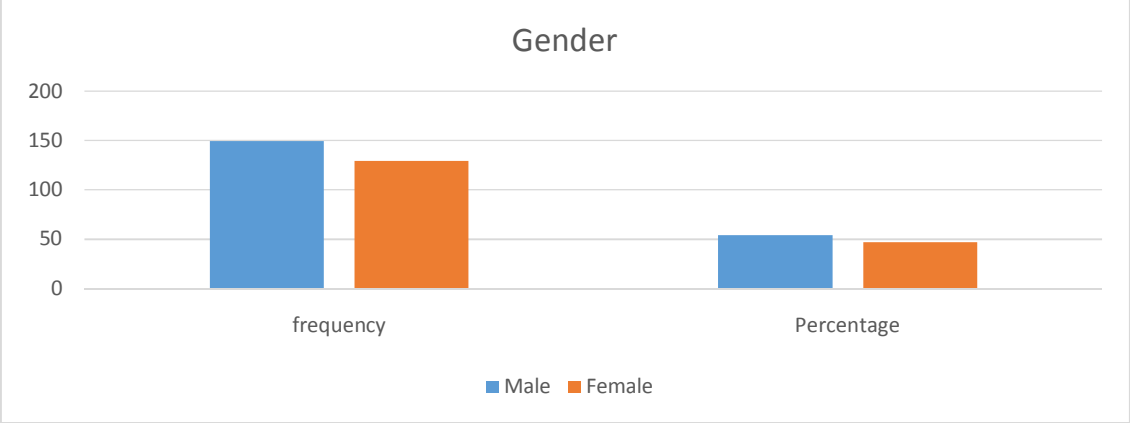

Figure 4: Gender

QUESTION ONE: What is the difference between the Academic Performance of Students taught with ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department?

TABLE 2: Descriptive statisticsondifference between the Academic Performance of Students taught with ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department

Variable	Groups	N	Mean	STD	Df	Mean diff.	t computed	Decision
Mean Performance	Exp.	140	80.46	2.16	276	53.00	10.62	Those taught with ICT Moodle had higher performances
	Control	138	27.45	2.13				

The descriptive mean statistics revealed that difference exist between the Academic Performance of Students taught with ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria. Their mean performances are 80.46 and 27.45by experimental students exposed to ICT Moodle and those of control groups respectively, indicating a mean increase of 53.00 among those exposed to ICT noodle. This shows that the students mean performances among the experimental group exposed to ICT Moodle is by far higher than those in the control group. ICT Moodle has high positive effect on students' Academic performance.

HYPOTHESES ONE: There is no significant difference between the Academic Performance of Students taught with ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department.

TABLE 3: t-test statistics on difference between the Academic Performance of Students in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department

Variable	Groups	N	Mean	STD	Df	Mean diff.	t computed	T critical	P	Decision
Mean Performance	Exp.	140	80.46	2.16	276	53.00	10.62	1.96	0.001	Significant difference at experimental
	Control	138	27.45	2.13						

$P < 0.05$, t computed > t critical; at df 276 $p = 0.001$, t computed = 10.62

Results of the independent t-test statistic above showed that significant difference between the Academic Performance of Students taught with ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department Reasons being that the calculated p value of 0.001 is lower than the 0.05 alpha level of significance and the

computed t value of 10.62 is greater thanthe 1.96 t-critical value at df 276. Their mean performances are 80.46 and 27.45 by experimental students exposed to ICT Moodle and those of control groups respectively, indicating a mean increase of 53.00 among those exposed to ICT Moodle. This shows that the students mean performances has greatly increased among the experimental group exposed to ICT Moodle as compared with the control group. Therefore, the null hypothesis which state that There is no significant difference between the academic performance of experimental and control groups in their mean score after exposure to E-learning Moodle, is hereby rejected.

QUESTION TWO: What is the effect of ICT approach on Polytechnic Students' retention ability and those taught with lecture Method in the department?

Table 4: Descriptive statistics on difference between the Retention Ability of Students exposed to ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department

Variable	Groups	N	Mean	STD	Df	Mean diff.	Decision
Mean Retention	Exp.	140	65.05	1.99	276	35.00	Significant increase at experimental
	Control	138	30.05	1.65			

Results of the Descriptive Mean statistics above revealed that difference exist between the Retention Ability of Students exposed to ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science departmentCase of Computer Science department. Their mean retention abilities are 65.05 and 30.05 by experimental students exposed to ICT Moodle and those of control groups respectively, indicating a mean increase of 35.00 among those exposed to ICT Moodle. This shows that the students retention ability has greatly increased among the experimental group exposed to ICT Moodle as compared with the controlgroup.

HYPOTHESES TWO: There is no significant difference on the effect of ICT Moodle on Polytechnic Students' retention ability and those taught with lecture Method in the department.

Table 5: t-test statisticsondifference between the retention ability of Students exposed to ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department.

Variable	Groups	N	Mean	STD	Df	Mean diff.	t computed	T critical	P	Decision
	Exp.	140	65.05	1.99						

Mean Retention				276	35.00	9.42	1.96	0.011	Significant increase at experimental
	Control	138	30.05	1.65					

P < 0.05, t computed > t critical; at df 276 p = 0.011, t computed = 9.42

Results of the independent t-test statistic above showed that a significant difference exists between retention ability of Students exposed to ICT Moodle and those taught with lecture method in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department. Reasons being that the calculated p value of 0.011 is lower than the 0.05 alpha level of significance and the computed t value of 9.42 is greater than the 1.96 t critical value at df 276. Their mean retention ability are 65.05 and 30.05 by experimental students exposed to ICT Moodleand those of control groups respectively, indicating a mean increase of 35.00among those exposed to ICT Moodle. This shows that the students retention ability has greatly increased among the experimental group exposed to ICT Moodle as compared with the control group. Therefore, the null hypothesis which state that There is no significant difference on the effect of ICT approach on Polytechnic Students' retention ability and those taught with lecture Method in the department, is hereby rejected.

DISCUSSION

The outcome of the study showed that ICT Moodle has significant effect on the academic performance of the students in Applied school. In fact, the mean performances are 80.46 and 27.45 by experimental students exposed to ICT Moodle and those of control groups respectively, indicating a mean increase of 53.00 among those exposed to ICT Moodle. The outcome was in agreement with Ajayi I.A. (2013) who affirmed that Information and Communication Technology (ICT) has helped to change the learning and teaching methods with proper use of computer and computer networks. The traditional way of learning through accessing a classroom physically, is not necessary nowadays in developed countries. Students can learn when they want and from where they want using a computer network.

CONCLUSION

The studies conclude that ICT Moodle have significant effect in improving the academic performance and even the retention of Students in School of Applied Science, Nuhu Bamalli Polytechnic, Zaria: Case of Computer Science department. The study is not biased it can be used in any of the departments in Applied schools comprising of Statistics and Science Laboratory. Technology and in other schools in Nuhu Bamalli Polytechnic, Zaria.

RECOMMENDATIONS

The paper recommended that:

1. The Kaduna State Government should provide adequate funds for the institution to acquire the necessary e-learning facilities for students to access. An Internet connection with a standby power-generating set should be provided.

2. Students and lecturers alike should learn how to utilize ICT facilities for instructional or educational purposes. Schools should adopt the use of e-learning for teaching and learning.

3. Education stakeholders should ensure a constant power supply and procurement of the requisite ICT equipment for students' use.

4. Education stakeholders should make efforts to ensure that an enabling environment is in place to drive away any possible obstacles to the usage of ICT at NUBAPOLY. ICT tools should constantly be upgraded to keep them current.

5. Lecturers should undergo training in appropriate skills in e-learning, and should be given computers to enable them to prepare their e-learning lectures and notes. Student Dropout Problem with Special Attention to e-Learning. DEOSNEWS,13(5) Retrieved 23.2.2015 from http://www.ed.psu.edu/acsde/deos/deosnews/deosnews13_5.pdf

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