

# Effects of E-Learning on Retention and Performance of Basic Science and Technology Students in Minna, Niger State

Tukura Charles Saidu<sup>1</sup>, Adamu Abdulmalik<sup>2</sup> & Kanu Judith<sup>3</sup>

<sup>1</sup>Department of Educational Technology, School of Science and Technology Education, Federal University of Technology, Minna

<sup>2</sup>Fati Lami Abubakar Institute for Legal and Administrative Studies, Nigeria

<sup>3</sup>Nigerian Education Research and Development Council (Nerdc), Sheda-Abuja, Nigeria

**Abstract:** This study investigated “Effects of e-learning on retention and performance among Basic Science Students in Minna, Niger State”. The research design adopted for the study was a Quasi-experimental control group design which employed a pretest, posttest, and post- posttest of the experimental and the control groups. The population of the study consisted of 4,870 JSSII Students from forty-one schools in Minna. Four schools were selected as sample for the study with a total number of 200 students. The instruments used for the study was Basic Science Performance Test (BSPT) with reliability coefficient of 0.89. The instrument was validated by two experts from the department of science education, Federal University of Technology, Minna. Intact classes of JSSII was used for the study. Four research questions were answered using descriptive statistic of mean and standard deviation, while four research hypotheses were formulated and tested using t-test at  $P \leq 0.05$  level of significance. One of the hypothesis answered was there is no significant difference in the level of performance between students taught Basic Science concept using e-learning and those taught using Lecture Method. Major findings of the study revealed that the use of e-learning has positive effect on Students’ Retention and Performance among Basic Science Students. Based on the research findings recommendations were made among which include, that Basic Science teachers in Junior Secondary Schools in Minna should be encouraged to use the e-learning in teaching and learning of Basic Science as it improves students’ performance; Both the State and the Federal Government should organize workshops, seminars and talk shows for Basic Science teachers on how to use e-learning in the teaching and learning process.

**Keywords:** Basic Science and technology, e-learning, retention, performance, students

## I. INTRODUCTION

Science and technology education plays a vital role in the socio-economic development of all nations. In view of this, developed countries like Britain, Australia, United States of America, Japan, to mention but a few are stressing the need for discoveries in fundamental materials of importance in all fields of sciences. This is done at an incredible rate through pursuing scientifically and technologically related programs in the institutions of learning. Bala (2010) asserted that in developing nations like Nigeria, various factors have contributed to the decay in the educational system, among

which is the misinterpretation of the nature of science and science education which can as well lead to in appropriate teaching that reduces the potential impact of science education as a tool for development in Nigeria.

Abdullahi (2014) pointed out that Nigeria could not achieve national development as science education has been put in a state of crisis in the Nation. He further pointed out that for the country to achieve development the problems associated with science education have to be eradicated. Some of these problems include, poor teaching skills, non application of science to production activities, inadequate teaching materials, poor funding, and non implementation of research findings among others. These problems therefore have led to underachievement in science education as reported by Nwagbo (2013). The culmination of the above problems have made it difficult to develop scientifically literate individuals that will be willing to learn science contents as well as acquire the science process skills.

Basic science is the science taught at the primary and junior secondary level in Nigeria. The syllabus of basic science is designed with a lot of activities, as such methods used for its teaching should be in such a way that it will allow the learner to learn through the activity based method of teaching. NTI (2013) reported that methods of teaching basic science should include the guided discovery method which is resource based.

Nwagbo (2013) opined that for a country to achieve national development, science and technology has to be taught in a well-structured pattern involving activities for both teachers and students. However the low performance of students in sciences as reported by the National Center for Science Education NCSE (2012) has put science education in the nation in a state of crisis. Nwagbo (2013) explained that the progress in the teaching and learning of basic science and technology still remained very slow, in spite of the introduction of the 6-3-3-4 system of education. However the problem of the implementation of the 6-3-3-4 system of education is partly due to the non availability of personnel, materials, funds and administrative will. In view of this short coming the researcher intends to test the effect of e-learning

on basic science and technology retention and performance among students in Minna, Niger State.

E-learning according to Craig (2007) is the computer and network enabled transfer of skills and knowledge for the diffusion of innovative teaching (Craig, 2007). E-learning according to Rosenberg is the process by which people acquire skills or knowledge for the purpose of enhancing their performance through the internet or intranet and multimedia which leads to reinforced learning by means of video, audio, quizzes and other forms of interaction. Aduwa-Ogiegbaen and Iyamu (2012) maintained that e-learning is all about learning with the use of technologies presumably computers and other modern day tools. E-learning involves the use of electronic technology to deliver education and training, to monitor learner's performance and to report the learner's progress. Hedge and Hayward (2014) view it as an innovative approach for delivering electronically mediated, well-designed, learner-centered and interactive learning environments to anyone, at any place, at any time. Its success is mainly based on its benefits and distinctive features; it is easily accessible, cost efficient, gives students the flexibility of learning, it helps provide uniform delivery to all users reducing chances of misinterpretations, as well as promoting team learning and collaboration. ICT applied to education is being deployed in varying modes from sector to sector; these range from basic e-learning or distant learning to the use of small device such as mobile phones. For the purpose of this study, the study intends to test the effect of e-learning on retention and performance among basic science students,

Jiya (2011) states that literally, the ability to store and remember ideas and facts is termed as retention. Ochonogor (2014) wrote that retention can be measured through verbal recall of learnt materials, and explained that concepts learnt assist in reflective thinking and that retained concepts can be used in creative ways to solve new problems.

Retention and performance in science, technology, and mathematics, are of paramount importance in science learning. Bichi (2012) also described retention as the ability to store and remember things experienced or learned by an individual at a later time. Oyedokun (2010) and Jiya (2011) argued that when teaching is characterized by rote learning, meaningless memorization, or verbalism, students learn ineffectively. However, Bichi (2012) believed, when there is interference among learned material; speed and efficiency of learning is often decreased. Whereas anything that aids learning should improve retention. Thus learned facts cannot be retained for a long time, nor can they have a significant effect on the learning outcome. Therefore, this research work intends to assess the effect of the use of e-learning on retention and performance among basic science students.

Performance can be explained as a term, which is directly proportional to change in a learning context, input, or classroom process. Performance, therefore, simply means the extent to which a student, a teacher, or an institution has

reached its educational goal. It is commonly measured by examinations or other means of evaluation of teaching and learning outcome. In another development, Sati (2014) described performance as a complex students' behavior that underlies several abilities. Examples include memory, previous knowledge or aptitude, as well as psychological factors like motivation, interest, temperaments or emotions. Adamu (2015) explained that the causes of low performance are diverse and cannot be associated with a single factor. For instance, proponents of self-concept and its variables may be a paramount factor in academic failure. Yoloye (2009) reported that performance in any form of activity is based upon study interpretation and application and that study has a purpose so it depends on the individual to decide why he or she wants to study. That is, either to gain new ideas or to find out relationship between two different things. In essence, what one learns as a result of study depends on the degree to which one succeeds. Hard work involves having common sense and using better organization and application of good study habit. Lawal (2017) revealed that students perform poorly in science secondary schools and a number of factors were found to be responsible for the poor attainment of the objectives of science instruction in regards to their gender.

Gender issues have arisen in studies carried out on many subjects in school curriculum. Findings from research carried out by Harding (2012) indicated that school curriculum and learning activities carry with it large dose of gender bias. Anekwe (2016) mentioned that the science and mathematics curricula are most frequently cited. He explained that such content area of force, gravity, pendulum, thermodynamics are closer to experiences boys would have or may have in the course of their development. Gender differences exist in career choice. It is observed that boys choose careers that can take them to top management or prestigious positions such as law, engineering, medicine, while girls go for careers in caring and service sector. For instance, nursing, welfare, teaching. The issue of concern is the embedded belief that some careers are exclusive to either sex, a trend which limits individual's options and robs the society of possible benefits. Consequently learners react differently to instructions and instructional materials due to gender.

## II. STATEMENT OF THE PROBLEM

The teaching and learning of Basic Science is dominated by the lecture method and is thought to be the major reason for learning disability and lack of interest on the part of the learners. The National Policy on Education (FME, 2013) states its objectives for science education is to cultivate the spirit of inquiry, produce competent scientist and to provide knowledgeable scientists. Usman (2014) called on the need to transform the teaching of science with a view to assisting the teaming youths to acquire skills that will make them self-reliant. Muoneme (2013) explained that the teacher and his method of teaching may have been the major cause of student's poor academic performance in basic science as most teachers still prefer using the "chalk and talk" method i.e. the

lecture method. The lack of trained teachers that can alter the conventional teaching methods to modern teaching strategies, as well as non-use appropriate instructional material for the teaching and learning process are all identified as factors resulting in poor performance among learners of science. The situation in Minna, Niger State is a clear indication of the poor performance.

#### *Purpose of the Study*

- i. Find out the difference in performance among students taught Basic Science concept using e-learning and those taught using Lecture Method
- ii. Determine the difference in the level of retention among Students taught Basic Science concept using e-learning and those taught using Lecture Method
- iii. Investigate the difference in the level of Performance between male and female students taught Basic Science concept using e-learning.
- iv. Find out the difference in the level of retention ability among male and female students taught Basic Science concept using e-learning,

#### *Research Questions*

- i. What is the difference in the level of performance between students taught Basic Science concept using e-learning and those taught using lecture method?
- ii. What is the difference in the retention ability between students taught Basic Science concept using e-learning and those taught using Lecture Method?
- iii. What is the difference in the level of performance between male and female students taught Basic Science concept using e-learning?
- iv. What is the difference in the level of retention between male and female students taught Basic Science concept using e-learning?

#### *Null Hypotheses*

- Ho<sub>1</sub>*: There is no significant difference in the level of performance between students taught Basic Science concept using e-learning and those taught using lecture method.
- Ho<sub>2</sub>*: There is no significant difference in the level of retention between students taught Basic Science concept using e-learning and those taught using lecture method.
- Ho<sub>3</sub>*: There is no significant difference in the level of performance between male and female students taught Basic Science concept using e-learning.
- Ho<sub>4</sub>*: There is no significant difference in the level of retention between male and female students taught Basic Science concept using e-learning.

### III. METHODOLOGY

The research design adopted for this study is a quasi-experimental control group design employing pretest, posttest and post-posttest. A pre-test was administered to both the

experimental and control groups using same test instrument before treatment; so as to determine the entry level. The study was carried in Minna, Niger State. The population of the study is 4,870 basic science students from 41 government owned junior secondary schools in Minna. The sample for this study is made up of four schools. Simple random technique was used to select the sample from the population. The selection was done by selecting ten schools by tossing from the population and was subjected to a pretest. The scores obtained from the test were subjected to ANOVA and later used scheffe's test to select four schools. Basic Science Performance Test (BSPT) was used as the instrument for data collection. The BSPT was validated by two experts from the Department of Science Education, Federal University of Technology, Minna. The Pilot study for this work was carried out on JSS II students of G.S.S. Bida in Niger State. This school is not part of the study. The aim of the pilot study was to determine the characteristics of the test items, which includes their facility and discrimination indices and reliability coefficient. The pilot study was conducted away from the study area in order to avoid interaction with the main subjects of the study. The instrument Basic Science Performance Test (BSPT) was administered to 50 students of Government Secondary School Bida. For the test re-test of these instruments only two weeks was allowed to elapse between the first test and the second test, in order to minimize the intervention of external factors in the final reliability coefficient that was obtained to be 0.89. Basic Science Performance Test (BSPT) was administered at the beginning of the exercise as pretest to determine the entry level of the students. Lesson was carried out in accordance with the lesson plan for both experimental and control groups respectively. The BSPT was to collect data after the administration of treatment as posttest. After a period of two weeks, post-posttest was administered. The scores of the experimental and control groups were recorded separately and subjected to data analysis.

The research questions were answered using descriptive statistic of mean and standard deviation. Inferential statistical of t-test was used to test the research hypotheses. Data generated were analyzed at  $p \leq 0.05$  level of significance.

### IV. RESULTS

*Research Question One:* What is the difference in the level of performance between students taught Basic Science concept using e-learning and those taught using lecture method?

Table 1: Mean Score of Performance for Experimental and Control Groups

Group	N	Mean pretest	Mean posttest	SD	MD
Experimental	100	12.19	27.75	3.63	8.69
Control	100	11.86	19.06	2.35	

Table 1 revealed that there was a difference in the performance between students taught Basic Science concept using e-learning and those taught using lecture method. The

pretest mean scores of experimental and control groups are 12.19 and 11.86 respectively. The posttest mean scores of performance between the Experimental and Control groups are 27.75 and 19.06 respectively with mean difference of 8.69 in favor of the experimental group.

**Research Question Two:** What is the mean difference in the level of Retention ability of students taught Basic Science using e-learning and those taught using Lecture Method?

Table 2: Mean Score for Level of Retention between Experimental and Control Groups

Groups	N	Mean	Std. Dev	MD
Experimental	100	29.49	5.265	16.77
Control	100	12.72	3.452	

Table 2 showed that there was a difference between students taught Basic Science concept using e-learning and those taught using Lecture Method. The computed mean scores of Retention are 29.49 and 12.72 implying a mean difference of 16.77 in favour of the Experimental group.

**Research Question Three:** What is the mean difference in the academic Performance of Male and Female students taught Basic Science using e-learning.

Table 3: Mean Performance Experimental Group Score for Male and Female Students

Group	N	Mean	SD	MD
Male	50	27.81	6.81	0.12
Female	50	27.69	6.66	

Table 3 showed that there was a difference in the level of Performance between Male and Female Students taught Basic Science concept using e-learning. Descriptive statistics revealed that the male and female performance scores were 27.81 and 27.69 respectively with mean difference of 0.12. This showed that the e-learning provided the same positive effect for both male and female students.

**Research Question Four:** What is the mean difference in the level of Retention between male and female Students taught Basic Science using Computer-Assisted Instructions?

Table 4: Mean Score for Retention between Male and Female Students in Experimental Group

Groups	N	Mean	Std. Dev	M D
Male	50	29.64	5.49	0.39
Female	50	29.34	5.08	

Table 4 showed there was no difference in the level of retention between male and female students taught Basic Science concept using e-learning. The computed mean scores of Retention were 29.64 and 29.34 for male and female

Students. The mean difference of 0.39 is in favour of the male students, even though this difference was not significant.

**Hypotheses Testing**

**Null Hypothesis One:** There is no significant difference in the level of performance between students taught Basic Science using e-learning and those taught using Lecture method.

Table 5: t-test Analysis of Posttest Mean Score of BSAT for Experimental and Control Groups

Group	N	Mean	SD	df	P-value	Remark
Experimental	100	24.28	4.18	198	0.00	Sig
Control	100	12.51	2.12			

Significant at  $p \leq 0.05$  level

Table 5 showed that the  $t = 19.86$  and  $p\text{-value} = 0.00$  at degree of freedom (df) 198. Since the  $p\text{-value} 0.00 \leq 0.05$ . It means that there is significant difference in the mean scores of the Experimental and Control groups. The significant difference is in favour of the Experimental group exposed to e-learning. Therefore, null hypothesis one was rejected.

**Null Hypothesis Two:** There is no significant difference in the level of Retention between Students taught Basic Science concept using Computer-Assisted Instruction and those taught using Lecture Method

Table 6: t-test Analysis of Post Posttest Mean Score for Experimental and Control Groups

Group	N	Mean	SD	df	P-value	Remark
Experimental	100	29.49	5.27	198	0.00	Sig
Control	100	12.72	3.45			

Table 6 showed that there was a significant difference in the level of retention between students taught Basic Science concept using e-learning and those taught using Lecture Method. Reasons being that the calculated  $p\text{-level}$  of 0.00 is lower than the 0.05 alpha level of significance at df 198. Their computed mean Retention are 29.49 and 12.72 by students taught Basic Science using e-learning and those taught using Lecture Method. The result is in favour of the experimental groups. Therefore, the null hypothesis two was rejected.

**Null Hypothesis Three:** There is no significant in the level of Performance between Male and Female students taught Basic Science using e-learning.

Table 7: t-test Analysis of Posttest Mean Score of BSPT for Experimental Group

Group	N	Mean	SD	df	P-value	Remark
Male	50	25.14	4.71	198	0.127	Not Sig
Female	50	25.50	4.82			

Table 7 showed that the  $p\text{-value}$  is 0.127, which is greater than  $\alpha \leq 0.05$  with degree of freedom (df) = 198. This means



that there was no significant difference between the posttest scores of male and female students exposed to e-learning. Therefore, null hypothesis three was retained.

*Null Hypothesis Four:* There is no significant difference in the level of retention between male and female students taught Basic Science using e-learning.

Table 8: t-test Analysis of BSAT for the Level of Retention between Male and Female Students in the Experimental Group

Groups	N	Mean	SD	df	P-value	Remark
Male	50	29.64	5.50	198	0.78	Not Sig
Female	50	29.34	5.08			

Table 8 showed that there was no significant differences in the level of retention between male and female students taught Basic Science concept using e-learning. Reasons being that the calculated p-value of 0.78 is higher than the 0.05 alpha level of significance and the computed t value of 0.28 at df 198. The computed mean of Retention are 29.64 and 29.34 by male and female Students taught Basic Science concept using e-learning in favour of the males, in spite of the fact that the difference was not significant, null hypothesis four was retained.

## V. DISCUSSION OF RESULTS

The findings of this study showed that significant difference existed in the level of performance between students taught Basic Science concept using e-learning and those taught using Lecture method. This finding is in agreement with Nwafor (2014) who investigated on the relative effects of Synchronized Multimedia on the Academic Performance and Motivation of Senior Secondary School Biology Students in Port Harcourt, Nigeria. The result showed that students that were taught Biology using Synchronized Multimedia performed significantly better than those taught using lecture method only. Also the finding this study contradicted with the finding of Putman (2010) who conducted a similar research in Northern Ohio, U.S.A. The study investigated the effect of teaching English Language, Arts, and Mathematics using e-learning. The finding revealed that there was no significant difference in students' performance among those taught using e-learning and those taught using lecture method.

The findings of the present study also showed that significant difference existed in the level of retention between students taught Basic Science using e-learning and those taught using Lecture Method. This finding is in agreement with the finding of Christian (2015) who investigated on the effect of the use of interactive multimedia board on student's perception among Grade Nine Science Students in Caucasias Sophomores (U.S.A). The findings proved that students found the use of Interactive Multimedia Board more interesting, and showed improved Retention and Performance. Thomas and Stocton (2010) who investigated the impact of e-learning on gender, retention and academic achievement among secondary school

students found that e-learning is not gender friendly. The result of the finding indicated that there is higher retention among female students.

The findings of this study also showed that there was no significant difference in the level of performance between male and female students taught Basic Science concept using e-learning. The finding is in agreement with Abu (2013) who conducted a study to investigate the effectiveness of Computer-based Science Simulations and Lecture Methods on performance in Biology among Senior Secondary School Students. The result showed that subjects taught with Computer-based Science Simulations Instruction performed better in Science, than those taught using the Lecture Method. This also agrees with the work of Bichi (2012) which showed no significant difference between male and female achievement in science. This result shows that e-learning is gender friendly. The finding of Belal (2011) who conducted a research on students' perceptions on computer-assisted learning at the Ashton Business School, Aston University Birmingham contradicted with the finding of the present study as the interviewers rejected the idea of replacing human tutors with machines and they believed that most of their learning occurs in tutorials.

The findings of the present study also showed that there was no significant difference in the level of retention between male and female students taught Basic Science concept using e-learning. This finding contradicted with the findings of Thomas and Stocton (2010) who investigated the impact of e-learning on gender, retention and academic achievement among secondary school students found that e-learning is not gender friendly. The result of the finding indicated that there is higher retention among female students. Similarly, the finding agree with the work of Geddes and Goraset (2010) whose investigation on the effect of Technology-Assisted Instruction on students' gender and retention ability among Senior Secondary School Biology students in Uganda, revealed that Technology-Assisted Instruction enhances retention and is gender friendly.

## VI. CONCLUSIONS

The role of ICTs in the education is recurring and unavoidable. Rapid changes in the technologies are indicating that the role of ICT in future will grow tremendously in the education sector. By observing current activities and practices in the education, we can say the development of ICTs within education has strongly affected on what is learned; How it is learned; When & where learning takes place; Who is learning and who is teaching. ICT also focuses modification of the role of teachers.

In addition to classroom teaching, they will have other skills and responsibilities. Teachers will act as virtual guides for students who use electronic media. Ultimately, the use of ICT will enhance the learning experiences of students. Also it helps them to think independently and communicate

creatively. It also helps students for building successful careers and lives, in an increasingly technological world.

## VII. RECOMMENDATIONS

1. Basic Science teachers in Junior Secondary Schools in Minna should be encouraged to use the e-learning in teaching and learning of Basic Science as it improves students' performance.
2. Both male and female students should be equally exposed to e-learning by science teachers, as an effective modern teaching technique for improvement of academic performance and retention.
3. Both the State and the Federal Government should organize workshops, seminars and talk shows for Basic Science teachers on how to use e-learning in the teaching and learning process.
4. The knowledge of e-learning should be a prerequisite for the enrollment of students into Senior Secondary School by the State ministry of education.

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