

**ADAPTING VIRTUAL LEARNING: IT'S IMPACT ON THE PERFORMANCE
AMONG COLLEGES OF EDUCATION MATHEMATICS STUDENTS IN NORTH-
CENTRAL NIGERIA**

By

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Abstract

This study investigated adapting virtual learning on students' performance among colleges of education in north-central Nigeria. This study employed the use of pretest posttest, control group quasi experimental research design involving two groups which were experimental and control group. A sample of 127 students was used out of population of 3137, the study employed the use of mathematics performance test with a reliability coefficient of 0.79 using pearson product moment correlations. Mean and standard deviation were used to answer the research questions while independent t-test were used to analyze the research hypotheses. The result of the findings showed that virtual learning has a positive impact on the performance of students as compared to traditional learning and male students performed positively higher than their female counterparts through the use of virtual learning. Based on the findings of this study, it was recommended that virtual learning needs to be given top priority as a means of learning mathematics. It is therefore, recommended based on this study that virtual learning should be encouraged among gender.

Keywords: virtual learning, performance, gender, mathematics

Introduction

Mathematics is an area of knowledge that includes topics as numbers, formulas and related structures, shapes and the spaces in which they are contained, and quantities and their changes (Bell, 2012). Mathematics is essential in the natural sciences, engineering, medicine, finance, computer science and social sciences (Restivo, 2013). Hence, there is no controversy over the statement that knowledge of mathematics is a creative endeavor, and it is a human activity which arises from experience and become an integral part of culture and society of everyday life and work (UCO, 2002). Mathematics is the foundation of science and technology and the functional role of mathematics to science and technology is multifaceted and multifarious that no area of science Technology and business enterprise escapes its application (Okereke, 2006). It is a subject that enables a learner to have adequate understanding and interpretation of concepts in science and technology, which brings about technology (Azuka, 2003). The subject is dynamic in nature and has its application in almost every field of knowledge. Therefore, a superficial knowledge of mathematics will affect the understanding and performance of a vast number of science disciplines.

Academic performance may be used to refer to an expression used to present students' scholastic standing (Inekwe, 2002). Teaching of mathematics at primary and secondary schools in Nigeria has not been very impressive, this can be partly blamed on instructional materials and poor basic knowledge (Korau, 2010). Hence, the need for trying another approach of learning through virtual which is among other modes of teaching where learning could take place; technology learning, work-based learning, blended learning, contextual learning, immersion learning, incidental learning, cross-curriculum learning, face-to-face learning.

Virtual learning is a learning experience that is enhanced through utilizing computers and/or the internet both outside and inside the facilities of the educational organization. The instruction most commonly takes place in an online environment. The teaching activities are carried out online whereby the teacher and learners are physically separated in terms of place, time, or both (Racheva, 2017).

Virtual education generally refers to instruction in a learning environment where teacher and student are separated by time or space, or both. The course contents are conveyed through information technology (IT) applications, multimedia resources, the Internet, videoconferencing, among others. Virtual learning can also be defined as distance learning conducted in a virtual learning environment with electronic study content designed for self-paced (asynchronous) or live web-conferencing (synchronous) online teaching and tutoring (Racheva, 2017). The quality of online education depends on the proper use of digital technologies in accordance with modern educational theories which are behaviorism, social constructivism and cognitivism. Virtual education has exploded during the past few years and become even more centric to the life of university and school worldwide during the outbreak of Covid-19 pandemic, in which schools were short down as a result of pandemic in the year 2020 (Salami, 2021). Together with the expansion of virtual courses are the increasing concerns about the quality of education it provides and the challenges faced by the teacher and the learner (Doan, 2020).

Heemskerk, Kuiper and Meijer (2014) reported that the effects of the combined use of an interactive whiteboard and a virtual learning environment on mathematics performance and motivation lead to positive result as students' performance mathematics was monitored during one school year and their motivation for mathematics was followed for 3 years. There was no relation between frequency of being taught with an interactive white board and mathematics performance. However, students' motivation for mathematics appeared to be positively related to the combination of lessons made for the interactive white board and availability of these lessons on the virtual learning environment. This availability was the main reason for students' acceptance and appreciation of the use of virtual learning environment. Students appeared to use the virtual learning environment mostly to prepare for tests and examinations that lead to their high performance in mathematics.

Another study carried out by Borba, Chiari, and Almeida (2018) on interactions in virtual learning environments: new roles for digital technology showed that both highlighted roles are related. These roles are how teachers, tutors, and students play a role in producing interactive digital didactic material and how digital technologies themselves can play a role in teaching distance learning courses. They transform teacher and student roles and participation in the virtual classroom, and an "agency of media" emerges in online mathematics education. Buentello-Montoya, Lomeli-Plascencia, and Medina-Herrera (2021) on the role of enhancing technologies in teaching and learning of mathematics through virtual reality and augmented reality at all academic levels during the timespan from 2015 to 2020 showed that both virtual

reality and augmented reality have seen acceptance by students but the use of technologies by lecturers may be complicated if lectures are not designed adequately.

Also, transitioning the elementary mathematics classroom to virtual learning: exploring the perspectives and experience of teachers (Martin, Harbour, and Polly, 2021) findings showed that there was a positive transformation of performance as they navigated an abrupt transition from a traditional face-to-face mathematics classroom to a virtual learning. Umoh and Akpan (2014) studied the challenges of blended e-learning tools in mathematics, a descriptive survey design conducted with 30 undergraduate students of the University of Uyo, Nigeria. A research questionnaire of students' perceptions on the challenges of blended e-learning tools in mathematics was used to elicit responses and results revealed that there is significant difference on students' perceptions towards the challenges of blended e-learning tools.

Cheryan, Meltzoff and Kim (2021) investigated classroom matter: the design of virtual classrooms influences gender disparity in computer science classes, examined whether the design of virtual learning environments influences undergraduates' enrollment intentions and anticipated success in introductory computer science courses. Changing the design of a virtual classroom – from one that conveys current computer science stereotypes to one that does not (Cheryan, Meltzoff and Kim, 2021). This has significantly increased women's interest and anticipated success in computer science. Statistical analyses indicated that gender disparities in interest and anticipated success in the stereotypically designed classroom were mediated by women's lower sense of belonging in that environment. Changing the design of virtual learning environments may be a vehicle that universities can use to signal belonging to a wider net of students, and thus increase students' likelihood of enrolling and succeeding in those classes (Cheryan, Meltzoff and Kim, 2021).

Salami (2021) on attitude of science education students towards the use of mobile learning in Nigeria showed that there is no significant difference in the mobile learning of students in terms of interest. This finding showed that genders' interest in mobile learning remains the same. The Florida Virtual School has examined the student achievement of more than 5,000 students over a 3-year period. This ground-breaking research showed no significant difference in gender performance in high school mathematics courses (Ohlson, 2013). A study by Julie (2022) on education of virtual learning environment, using a student-centered evaluation model design, aimed at evaluating the quality of students learning experiences after the introduction of a virtual learning environment in two UK institutions and the result of the findings showed that individual difference does not influence the performance of students.

In all the related literatures above, each of the above findings have substantially done well in its various locations, and variables but more researches with different locations needs to be conducted. Hence the need for this present study which is adapting virtual learning: its impact on the performance among colleges of education mathematics students in north-central Nigeria.

Statement of the Problem

In the world today, there is an increase rise in the adoption of virtual learning as the new normal over the traditional learning. There are so many reasons why one should consider the adoption of virtual learning such as insecurity, insurgency, boko haram, Fulani herdsmen, Indigenous People of Biafra (IPOB) militants among others in Nigeria, and the increase rate of

the use of devices (laptops, smart phones, and tablets) by both young and old, its conveniences without having to move from one location to another provided all you need to connect to virtual learning is at your beck and call. This high rate of insecurity in Nigeria calls for another plan towards a successful educational system in Nigeria which gave birth to this present study, effects of adapting virtual learning on students' performance among colleges of education in north-central zone Nigeria.

Objectives of the Study

The objectives of this study are stated as follows:

1. to find out the difference in the mean performance of mathematics students via virtual learning and the traditional learning
2. to ascertain the difference in the mean performance of male and female students using virtual learning in mathematics.

Research Questions

1. What is the difference in the mean performance of students taught mathematics via virtual learning and traditional learning?
2. What is the difference in the mean performance of male and female students taught mathematics via virtual learning?

Research Hypotheses

1. There is no significant difference in the mean score of mathematics students taught via virtual learning and traditional learning.
2. There is no significant difference in the mean score of male and female students taught mathematics via virtual learning

Methodology

This research employed the use of pretest posttest, control group quasi-experimental design. The study consisted of two groups which are experimental and control group. The population of the study comprised of all students studying mathematics in the combinations of mathematics/computer, mathematics/biology, mathematics/chemistry, mathematics/physics, mathematics/economics, mathematics/geography with a total of 3137 students of 19 NCE II mathematics combination students of colleges of Education in the North-Central of Nigeria. The number of male students were 2034 while that of female were 1103, from this, a random sample of two Colleges of Education was made using a table of random numbers, where college A was randomly assigned experimental and College B was control group using flipping of coin as suggested by Bryman (2008).

A sample of 127 were selected using a purposive sampling techniques as factors such as availability of internet services, computer devices and its usage was considered. The experimental group consisted of 32 males and 31 females making a total of 63 subjects under the experimental group while the control group has 35 males and 29 females making a total of 64 subjects under the control group. Statistics from National Commission for Colleges of Education (NCCE, 2021) showed that there are thirteen state-owned Colleges of Education, three private Colleges of Education and three Federal Colleges of Education in north central of Nigeria. The experimental group was taught via virtual learning while the control group was taught via traditional learning.

The instrument used for the collection of data was Mathematics Performance Test (MPT) which consisted 50 multiple choice questions scoring 2marks each making a total of 100%. The reliability coefficient of the instrument was calculated to be 0.79 with test retest using Pearson Product Moment Correlations (PPMC). The experimental group was exposed to learning mathematics via virtual learning while the control group was taught mathematics via traditional teaching method.

Results

Research Question One: What is the difference in the mean performance of students taught mathematics via virtual learning and traditional learning? Table 1 was used to answer the research question one.

Table 1

Descriptive statistics on difference in the mean score of mathematics students taught via virtual learning and traditional learning

Variable	Study Groups	N	Mean	STD	Mean diff
Performance	Experimental	127	32.85	12.14	20.77
	Control	127	12.08	4.18	

The descriptive statistics in table 1 showed that difference exist in the mean score of mathematics students taught via virtual learning and traditional learning. The computed Mean performance of those students taught via virtual learning and traditional learning are 32.85 and 12.08 respectively with a mean difference of 18.23 in favor of those students taught via virtual learning.

Research Question Two: What is the difference in the mean performance of male and female students taught mathematics via virtual learning? Table 2 gave the descriptive analysis of the research question 2

Table 2

Descriptive statistics on difference in the mean score of male and female students taught mathematics via virtual learning

Variable	Gender	N	Mean	STD	Mean Diff
Performance	Male	67	35.19	12.12	0.4
	Female	60	30.23	11.72	

Results of the descriptive statistics in table 2 showed that difference exist between the mean score of male and female students taught mathematics via virtual learning. The computed mean performance of male and female students taught via virtual learning are 35.19 and 30.23 respectively with a mean difference of 4.96 in favor of the male students taught via virtual learning

Testing of hypotheses

Hypothesis One: There is no significant difference in the mean score of mathematics students taught via virtual learning and traditional learning.

Table 3

Independent t-test statistics on difference in the mean score of mathematics students taught via virtual learning and traditional learning

Variable	Study Groups	N	Mean	STD	Mean diff	Df	t-comp	t-critical	p- value
	Experimental	127	32.85	12.14					
Performance					20.77	252	18.23	1.96	0.00
	Control	127	12.08	4.18					

p value < 0.05, t computed > 1.96 at df 252

Results of the independent t-test statistics above showed that significant difference exist in the mean score of mathematics students taught via virtual learning and traditional learning. Reasons being that the p value of 0.00 is lower than the 0.05 alpha level of significance and the t computed value of 18.23 is greater than the 1.96 t critical value at df 252. The computed Mean performance of those students taught via virtual learning and traditional learning are 32.85 and 12.08 respectively with a mean difference of 18.23 in favor of those students taught via virtual learning. Therefore the null hypothesis which state that there is no significant difference in the mean score of mathematics students taught via virtual learning and traditional learning, is hereby rejected.

Hypothesis Two: There is no significant difference in the mean score of male and female students taught mathematics via virtual learning.

Table 4

Independent t-test statistics on difference in the mean score of male and female students taught mathematics via virtual learning

Variable	Gender	N	Mean	STD	Mean diff	Df	t- cal	t critical	p value
	MALE	67	35.194	12.115					
Performance					4.960	125	2.339	1.96	0.021
	FEMALE	60	30.233	11.720					

p value < 0.05, t computed > 1.96 at df 125

Results of the Independent t-test statistics above showed that significant difference exist in the mean score of male and female students taught mathematics via virtual learning. Reasons being that the p value of 0.021 is lower than the 0.05 alpha level of significance and the t computed value of 2.339 is greater than the 1.96 t critical value at df 125. The computed mean performance of male and female students taught via virtual learning are 35.1947 and 30.233 respectively with a mean difference of 4.960 in favor of the male students taught via virtual learning. Therefore the null hypothesis which state that there is no significant difference in the mean score of male and female students taught mathematics via virtual learning, is hereby rejected.

Discussion

The descriptive statistics in table one showed that the mean performance of students taught mathematics via virtual learning is very high. The result of table three also showed that significant difference exist in the score of students taught via virtual learning and traditional learning. Therefore, the null hypothesis which states that there is no significant difference in the mean score of students taught via virtual learning and traditional learning is hereby rejected. This shows that virtual learning has a positive impact on the performance of students. This study is in agreement with the work of Heemskerk, Kuiper and Meijer (2014) who reported that the effects of the combined use of an interactive whiteboard and a virtual learning environment on mathematics performance and motivation lead to positive result. Students' accepted and appreciated the use of virtual learning environment. Students appeared to use the virtual learning environment mostly to prepare for tests and examinations that lead to their high performance in mathematics. This result is also supported by the work of Borba, Chiari, and Almeida (2018) which showed that students and teachers participation in an online learning has a high interactive impact. Buentello-Montoya, Lomeli-Plascencia, and Medina-Herrera (2021) findings showed that virtual reality was accepted by students as it leads to high achievement in education. Martin, Harbour, and Polly (2021) findings showed that there was a positive transformation of performance as they navigated an abrupt transition from a traditional face-to-face mathematics classroom to a virtual learning.

The result of table 2 showed that the mean performance of male is higher than their female counterparts. The result of table 4 showed that there exist a significant difference in the mean score of male and female students taught mathematics via virtual learning. Therefore the null hypothesis two is hereby rejected. The result showed that male students performed better than female students when taught via virtual learning. This is in disagreement with the work of Salami (2021), in this finding, the result showed that there is no gender difference in the use of mobile learning; Chervan, Meltzoff and Kim (2021). This result showed that there is significant increase in women's interest and anticipated success in computer science. The work of Ohlson (2013) showed no significant difference in gender performance in high school mathematics courses. A study by Julie (2022) findings showed that individual difference does not influence the performance of students.

Conclusion

In conclusion, the use of virtual learning is highly effective on the performance of students' mathematics among colleges of education students in north-central Nigeria. This study have also shown that the virtual learning needs to be giving a top priority as a means of teaching and learning by ensuring adequate and sufficient electricity, internet facilities, computer devices and any other facilities that could necessitate the use of virtual learning in

Nigeria. Female students should be exposed to the use of devices for the purpose of learning as this will enable them to be well familiar with the use of virtual devices for virtual learning.

Based on the result of the findings, it is concluded that the use of virtual learning should be encouraged as students' mathematics performance was found to be relatively high and education via virtual learning was considered to be of a propelling tool towards the realization of quality education and sustainable educational system in Nigeria. Based on the findings, this study is in conclusion that female students' poor performance compared to their male counterpart could be as a result of level of exposure and usage of virtual learning and hence should be encouraged to involve in virtual learning.

Recommendations

- 1 Based on the findings of this study, it is recommended that the use of virtual learning for learning of mathematics should be encouraged over traditional means of teaching
- 2 It was recommended based on this findings that female students should be encouraged and exposed to the use of virtual learning, necessary devices should be made available to female students to enable them learn and perform well in mathematics.

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