E-learning of Mathematics and Students' Perceptions in Public Secondary School, Oyo State, Nigeria

A. E. Kayode[1,2(✉)] and E. O. Anwana[1]

[1] Faculty of Management Science, Durban University of Technology, Durban, South Africa
`aderinsolaK@dut.ac.za`
[2] Department of Educational Management, Faculty of Education, University of Ibadan, Ibadan, Nigeria

Abstract. Purpose: Integration of e-learning in classroom-based with mathematics courses/modules is recognized in all secondary schools, because mathematics subject have ability helps students to perform well in other subjects.

Design/Methodology/Approach: Descriptive survey research design with quantitative data approach through structured questionnaire. The reliability confirmed the Cronbach's Alpha and the coefficient was 0.78. 120 students were purposively selected from 36 secondary schools in Ibadan North, a local government area of Ibadan, capital of Oyo State in Nigeria. At a significance threshold of 0.05, four research questions and two hypotheses were developed.

Findings: The findings showed that e-learning platforms are not maximally utilized in mathematics among students in secondary school in Oyo State due to restrictions and difficulty of use as well as the students' preference for traditional learning.

Implications/Research Limitations: The study showed that there was a significant relationship between e-learning and students' perceptions of mathematics learning, though with weak correlation. The study was limited to only secondary school in Oyo State and therefore, could not be generalized to all other secondary schools in Nigeria.

Practical Implication: e-learning method serves as alternative to support teaching and learning using blended learning tools to support the classroom-based education, especially during this Post-COVID-19 pandemic.

Social Implication: This research study will encourage both teacher and students to embrace technological tool in teaching and learning for the improvement on students' academic performance.

Originality/Value: This study encouraged that mathematics teachers should make an effort to maximize the benefit of e-learning in mathematics to create a greater impact in teaching and learning. And also, students should use the opportunity to improve on their self-pace studies using asynchronous method of online.

Keyword: E-learning · Integration · Mathematics · Public secondary school · Students

1 Introduction

Human beings have always devised ways to survive, from the Stone Age to present today, which is why human beings have always tried to make things easier for themselves by using technological tools in education (Edara 2021; Govender & Kayode 2020). This has led to the birth of ideas, a materialization of thoughts and the birth of technological ages; and has led us to where we now, the internet age, where everything and every resource needed for life is at an individual's fingertips (Gui & Büchi 2021).

Students have perceived mathematics as very difficult and hard to understand. Using online learning resources, the world has become connected into one global city where all kinds of political, economic, social and even educational sectors are interconnected. Students' perception towards school in general, and mathematics in particular, and ideas closely related to students' attitudes towards mathematics in this technological age have been studied globally for over four decades (Moreno-Guerrero et al. 2020).

The integration of E-learning integration is a dignified to traditional education process using electronic resources. Computers and the internet are the strengths of e-learning, even though instruction can take place in or outside of classrooms (Babu & Sridevi 2018). E-learning can also be a network-enabled method of education and skill transfer which can be provided to a large number of students either simultaneously or at different locations. Initially, E-learning was not frequently used with traditional education sector. Nevertheless, as educational technology advanced and learning strategies improved, teaching and learning positively (Govender & Kayode 2020).

Blending technology tool with traditional education formed the foundation for this digital revolution and made teaching and learning dependent on digital tools, which found an essential place in a learning environment like the classroom; likened to classroom-based learning, in which online learning is alleged to dearth of interactivity (Alfadil et al. 2020; Governder & Kayode 2020). This is mostly caused by a lack of social engagement, social presence, and student pleasure. However, online learning has been marketed as being more affordable and practical than traditional educational settings and as giving more students the chance to further their education. (Bali & Liu 2018; Nafukho & Chakraborty 2014).

Previous studies have been examined on how students feel about online and tradition education learning and how satisfied they are with it. (Rathor 2022; Lazarevic & Bentz 2020; Berga et al. 2021; Nambiar 2020). In previous researchers, Fortune et al. (2011) looked into the learning preferences of the 156 students who participated in the two alternative learning modalities for a recreation and tourism course at a multicultural institution in Northern California, United States of America, did not differ statistically significantly from one another.

According to Bali and Liu's (2018), their study showed that online and traditional learning is unaffected by a university's courses level. There was no statistically significant difference in learning views between participants engaged in the e-learning and traditional learning courses. Although many people find face-to-face learning more gratifying, they prefer online learning because it is more convenient, saves time, and allows them to work when they want to rather than when they have to.

Some studies revealed that some students struggle with e-learning due to a lack of access to online facilities, thereby preventing them from learning through online

modes during the Covid-19 lockdown. Therefore, some researchers have recommended using a blended method in teaching and learning (Aboagye et al. 2020; Aboagye 2021; Srinivasan et al. 2021).

Mathematics is one of the most dreaded subjects at almost all levels of schooling. Most students are necrophobic, resulting in many secondary school students finding it impossible to understand mathematics and in a low uptake in mathematics classes and high levels of failure (Mazana et al. 2020). As the world is changing, so is the dynamism in technology that cuts across every sphere, including education. For example, the Covid-19 lockdown has resulted in a rise in e-learning, especially in Africa, where teaching and learning moved to virtual methods and allowed students to learn from home.

2 Research Questions

The research questions addressed the problem of the study:

i. What are the e-learning tools available in public secondary schools? in Oyo State, Nigeria?
ii. To what extent are these e-learning platforms used among secondary students in Oyo State, Nigeria?
iii. What are the challenges of learning Mathematics through e- learning among public secondary school students?

3 Research Hypothesis

At a 5% level of significance, the following hypothesis was developed in an effort to fully meet the study's goal:

Ho1 - There is no significant relationship between e-learning and students' perceptions of mathematics learning in public secondary school.

4 Literature Review

Learning and technology tools are the two significant supports of e-learning. (Saeed Al-Maroof et al. 2020). Technology is an enabler of the learning process, which means that it is utilized in education just like any other tool, like a pencil or a notebook. Learning is a cognitive process for acquiring knowledge (Aparicio et al. 2016).

Francis Bacon, a British philosopher who lived in the 1600s, said, "knowledge is power" (Wojciuk & Górny 2018; Serjeantson 2014). Thus, the one who knows possesses power, while the uneducated are helpless. But knowledge is also power, irrespective of whether e-learning or traditional education. Education has a prominent role to play in people's lives (Algahtani & Rajkhan 2020). Previous research outlined the significance of education and information in influencing people's perceptions of economic and social growth. (Benjamin et al. 2021). 'Highly educated' groups of people are more fiercely competitive. And are more likely to get competent employment and, as a result, better opportunities to better their life. Education has the most profound implication for people's

lives. Anderson et al. (2012) and Al Hadid (2022) stressed that the usefulness of the internet and the effect of e-learning in teaching and learning to impact more skills in technology to collaborate among students. These new technologies have and continue to offer non-traditional students educational options and higher education institutions the allure of economic riches.

Researchers emphasized that teachers and students should integrate the use of information and communication technologies (ICTs) with classrooms-based learning in today's educational system (Rahman et al. 2021). While e-learning is considered the best alternative for enabling students to use different type of ICT tools in their learning (Petretto et al. 2021; Valverde-Berrocoso et al. 2020; Wellington & Clarence (2021). E-learning method are vibrant for both teachers and students, according to numerous research studies (Bhuasiri et al. 2012; Arkorful & Abaidoo 2015). Accessibility to technological tools in education allows more flexible solutions for students to have an opportunity to study online to blend their learning with classroom-based. (Kayode 2019). According to recent study, improved flexibility is another significant improvement that ICT and e-learning bring, enabling universities all over the world to accept more students (Rakic et al. 2019, Govender & Kayode 2020). Integration of e-learning into students' learning modes has shifted traditional teaching and learning towards e-learning, though teaching during this period of Covid-19 has also proven relatively expensive (Kayode & Ekpenyong 2022; Srinivasan et al. (2021). However, there appears to be a consensus among academics that the usage of e-learning in higher education has several benefits and, given its several advantages and benefits, e-learning is considered among the best methods of education. Several studies and authors have provided benefits and advantages derived from adopting e-learning technologies in schools (Algahtani 2011; Reed et al. 2010; Even & Ball 2019; Collins & Halverson 2018; McGee et al. (2017).

5 Methodology

This study adopted a descriptive survey method to explore e-learning and students' perception of mathematics in public secondary schools in Oyo State, Nigeria. The reason for dopting descriptive survey research is to generalize the population so that inferences can be made, and to allows the researcher to collect data without manipulating any variables of interest to the study.

6 Study Population

The target population of this study is students in public senior secondary schools (SS1-SS3) students in Ibadan North Local Government Area, with 36 public senior secondary schools that range from Senior Secondary School One (SSS1) to Senior Secondary School Two (SSS2).

7 Sample and Sampling Procedure

Six senior secondary schools were chosen at random from the 36 senior secondary schools in the Ibadan North Local Government Area. (Polytechnic High School, Polytechnic Campus, Immanuel Grammar School, Orita U.I, Community Secondary School,

Sango, Community High School Agbowo, Bodija, Ijokodo High School, Ijokodo, and Abadina College Senior School). From each of the six schools selected, 20 students were randomly selected to arrive at 120 students who serve as participants in this research.

8   Research Instruments

The research instrument used for this study was a structured questionnaire which was used to collect information from the participants. The questionnaire consisted of statements drawn by the researcher in line with the entire concept of the study to bring into focus the problem under study. The questionnaire was divided into sections. Section A of the questionnaire was for the respondent's demographic information. The questionnaires were administered to school students in the above-mentioned local government area.

9   Quantitative Analysis

Frequency tables were used to extract the replies from the copies of the questionnaire given to the respondents and then code and present them using the statistical tools for social sciences (SPSS) and simple percentage. Furthermore, Chi-square distribution test was used to analyse the data and the results were reported with the aid of descriptive statistics.

10   Results and Discussion

The results are presented according to each research question and triangulated in the discussion (Table 1).

Table 1. Opinions of the respondents on the availability of e-learning platforms

Items	SA	A	U	D	SD	Total	X	SD
My School have provided us social media platforms for learning	56.3	37.0	5.0	1.7	–	100	1.52	.675
I have access to internet facilities in my school	27.7	46.2	20.2	5.0	0.8	100	2.05	.872
I have easy access to internet facilities and social media platforms at home which aids my learning in school	26.1	48.7	19.3	5.0	0.8	100	2.06	.857

*X = mean; SD = Standard Deviation; *SA = Strongly Agree (1); A = Agree (2); U = Undecided (3); D = Decided (4); SD = Strongly Decided (5).*

The results express the availability of e-learning platforms used amongst public secondary schools in Oyo State, Nigeria. The results show that for the majority of the respondents (93.3%, 73.9% and 74.8%, with mean and standard deviation scores of

1.52/0.675, 2.05/0.872 and 2.06/0.857 respectively) their schools provided them with social media platforms for learning, they had access to internet facilities in their schools and had easy access to internet facilities and social media platforms at home, all of which aided their learning in school. This shows that e-learning platforms are available for use in public secondary schools in Oyo State, Nigeria (Table 2).

Table 2. Opinions of the respondents on the extent of use of available resources

Items	SA	A	U	D	Total	X	SD
My teacher always gives us assignment that requires the use of internet	61.3	31.1	5.0	2.5	100	1.49	.711
My teacher always uses social media to give us learning instruction	31.9	54.6	8.4	5.0	100	1.87	.769
I always make use of social media platforms for learning in my school	22.7	48.7	23.5	5.0	100	2.11	.811
I have access to internet facilities in my school but I am forbidden to use them	21.8	35.3	30.3	12.6	100	2.34	.959
I have access to internet facilities but often find it difficult to use them	19.3	33.6	23.5	23.5	100	2.51	1.057
I have access to e-learning facilities but I prefer traditional learning to e-learning	25.2	33.6	25.2	16.0	100	2.32	1.025

X = mean; SD = Standard Deviation.

The results reveal the extent to which the available e-learning tools were used for mathematics learning among secondary school students in Oyo State, Nigeria. The results show that the majority of the respondents (92.4%, 86.5%, 71.4%, 57.1%, 52.9% and 58.8%, respectively) with mean and standard deviation scores of 1.49/0.711, 1.87/0.769, 2.11/0.811, 2.34/0.959, 2.51/1.057 and 2.32/1.025 agreed that their teachers always gave assignments that required the use of the internet; always used social media to give instructions; and always made use of social media platforms for learning in their school. They also agreed that their school provided access to internet facilities, but that they were often forbidden to use them or found it difficult to use them; and that they preferred traditional learning to e-learning. This shows that e-learning tools are not used to their full potential for mathematics learning among secondary students in Oyo State, Nigeria due to restrictions and difficulty of use, as well as a preference for traditional learning by the students (Table 3).

Table 3. Opinions of the respondents on the challenges in the use of e-learning

Items	SA	A	U	D	SD	Total	X	SD
Lack of feedback from peers	35.3	21.0	14.3	16.0	13.4	100	2.51	1.449
Lack of feedback from instructor in time	15.1	40.3	13.4	19.3	11.8	100	2.72	1.268
Workload not shared equally	12.6	36.1	17.6	22.7	10.9	100	2.83	1.230
Low or no collaboration of other classmates	11.8	30.3	26.1	22.7	9.2	100	2.87	1.168
Some set of students dominating the group discussion	9.2	30.3	21.8	28.6	10.1	100	3.00	1.172
Lack of time to participate in the group page	10.9	24.4	22.7	25.2	16.8	100	3.13	1.266

The results reveal the challenges of mathematics e-learning among public secondary school students. The result showed that the many of the students (56.3%, 55.4%, 48.7%, 42.1% and 39.5%, respectively), 2.51/1.449, 2.72/1.268, 2.83/1.230, 2.87/1.168, 3.00/1.172 and 3.13/1.266 agreed that lack of feedback from peers, lack of feedback on time from instructors, workloads not shared equally, low or no collaboration between classmates, with some groups of students dominating the group discussion, constitute challenges for mathematics e-learning among public secondary school students. A lower percent of the students (29.4%, 31.1%, 33.6%, 31.9% and 38.7%, respectively) felt that a lack of time to participate in the group page did not constitute a challenge to e-learning in mathematics as opposed to a lower percent (35.3%) that said it did. This shows that lack of feedback from peers and instructors on time, inability to share workloads equally, low or no collaboration with other classmates and some sets of students dominating the group discussion constituted the main challenges for e-learning in mathematics usage among public secondary school students.

11   Research Hypothesis

The following hypotheses was tested at 0.05 level of significance:

Ho$_1$ There is no significant relationship between e-learning and students' perception on mathematics learning in public secondary school.

The Spearman's rank-order correlation between e-learning and students' perceptions of mathematics learning in public secondary school is shown in Table 4. These results reveal weak positive correlation values between +0.116 to +0.285 which are insignificant at the p-value of 0.210 ($p < 0.05$). This shows that there is significant relationship between e-learning and students' perception of mathematics learning in public secondary school. Therefore, the null hypothesis was rejected.

Table 4. Results of Spearman's rank-order correlation analysis between e-learning and students' perception on mathematics learning in public secondary school.

Item	Choose only one e-learning platforms used mostly in your school	
	Correlation coefficient	Sig.
My school has provided us social media platforms for learning	0.242[**]	0.008
I have access to internet facilities in my school	0.244[**]	0.008
I have easy access to internet facilities and social media platforms at home which aids my learning in school	0.116	0.210
E-learning offer interesting instructional materials	0.285[**]	0.002

[**]$P < 0.01$.

12 Conclusion

The results show that e-learning platforms are available for use in public secondary schools in Oyo State, and there is an impact on students' perception.

However, the benefit of using e-learning to teach mathematics can be maximized if mathematics teachers effectively use e-learning for the benefit of students, provide feedback on time and improve collaboration. This was in line with the study of Babu and Srideve (2018) that teaching and learning based out of traditional education with the use of computer and internet in e-learning.

Respondents attested that their schools provided them social media platforms for learning, they have access to internet facilities in their schools and have easy access to internet facilities and social media platforms at home which aids their learning in school.

However, e-learning platforms are not used to their full potential for mathematics and technological tool in students' learning among secondary students in Oyo State, Nigeria due to restrictions and difficulty of use, as well as a preference for traditional learning by the students.

The majority of the students agreed that lack of feedback from peers, lack of timeous feedback from instructors, workloads not shared equally, low or no collaboration between classmates, with some students dominating the group discussion, constituted challenges for the e-learning of mathematics in public secondary schools.

Thus, it can be concluded that there is a significant relationship between e-learning and students' perceptions about mathematics learning in public secondary school (Bhuasiri et al. 2012; Arkorful & Abaidoo (2015). Kayode (2019) in the study supported that the accessibility to technological tools in education allows more flexible solutions for students to have an opportunity to study online – despite the student's geographical location. Therefore, the role of e-learning of mathematics in public secondary schools requires attention and further research.

Additionally, there is no significant difference between male and female students' perceptions of mathematics learning in public secondary school. The two genders do not

have different perceptions pertaining to how e-learning impacts mathematics learning in public secondary schools.

Based on the findings and conclusions drawn, the following recommendations are hereby offered:

Mathematics teachers should be given opportunities to update their knowledge periodically through in-service training and retraining courses to enrich their knowledge on how to adequately maximize the opportunities e-learning has to offer in mathematics.

Mathematics teachers should make sure equal opportunities are given to all the students and also improve good communication and feedbacks.

Finally, students should maximize e-learning opportunities both in school and also in their respective homes.

13   Recommendation

The following recommendations are made:

– Improve feedback between peers, and encourage workload equity among students in public secondary schools.
– Mathematics teachers should improve their knowledge in e-learning platforms activities, so to impact positively to students learning.
– Students should use the e-learning platforms in school and at home for better understanding and for skills improvement; since findings shows that e-learning platforms are available for use in public secondary schools in Oyo State, Nigeria.

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