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Electronic-Learning tools Availability and Usability for teaching and learning mathematics in Polytechnics of North-East Nigeria during the post Boko-Haram insurgency

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Abstract

The research "Electronic-learning tools availability and usability for teaching and learning of Mathematics in polytechnics of North-East Nigeria" was guided by two (2) objectives, two (2) research questions. A descriptive survey research design was employed in the study. The researchers used quantitative method for data collection. The population of the study was 47,289 participants comprising of 3,020 academic staffs and 44,269 students in 12 public polytechnics in North-East Nigeria. Multi-stage sampling of Stratified and simple random sampling techniques was employed in selecting the sample. The entire sample chosen are 381 consisting of 24 academic staffs and 357 students from polytechnics in north-east, Nigeria. A questionnaire was used for data collections. The two (2) research questions were answered with the aid of descriptive statistics of mean and standard deviation. The students in polytechnics in north-east, Nigeria, would benefit from this study by showing them numerous academic benefits they stand to gain in the case of availability and usability of the e-learning during post Boko- Haram insurgency in north-east Nigeria in upholding their academic activities. Moreover, e-learning would enable the students to collaborate with their academic staff and their course mate for academic purposes during post Boko- Haram insurgency.

Keywords: E-learning, Availability, Usability, Teaching, Learning and Mathematics

Introduction

The role of electronics-learning (e-learning) tools in the teaching and learning of mathematics has become increasingly significant in higher institutions,

particularly in polytechnics. The integration of these technologies enhances instructional delivery, fosters interactive learning, and improves students' understanding of mathematical concepts (Oyelekan *et al.*, 2019). However, in the wake of the Boko Haram insurgency, polytechnics in Northeast Nigeria have faced numerous challenges that have impacted the availability and usability of e-learning tools.

The post-insurgency era has left a trail of infrastructural destruction, displacement of students and teachers, and a weakened educational system (Yusuf and Balogun, 2020). Despite efforts to rebuild educational institutions, access to e-learning tools remains limited due to inadequate funding, lack of skilled personnel, and security concerns (Adebayo, 2021). According to Iloanusi and Osuagwu (2025), the effectiveness of e-learning tools in Nigerian polytechnics depends not only on their availability but also on their usability, which is determined by digital literacy levels among educators and students, as well as institutional support.

Moreover, the usability of these tools is often hindered by poor electricity supply, weak internet connectivity, and the high cost of digital devices (Aliyu, 2023). While e-learning can serve as a solution to the learning gaps created by insurgency-related disruptions, its adoption in Northeast Nigerians' polytechnics is still in its infancy. Studies by Okonkwo and Hassan (2023) highlight that government and institutional efforts should focus on improving access to digital infrastructure, training educators, and creating an enabling environment for technology-driven mathematics education. This study, therefore, aims to examine the availability and usability of e-learning tools for mathematics education in polytechnics within Northeast Nigeria during the post-Boko Haram insurgency. Understanding the challenges and opportunities in this setting will provide insights for policymakers, educators, and stakeholders to enhance the effectiveness of digital learning strategies in conflict-affected regions.

Statement of the Problem

Mathematics is a fundamental subject in polytechnics, serving as the backbone for various technological and engineering disciplines. However, in North East Nigeria, the availability and usability of electronic learning (E-learning) tools for teaching and learning mathematics remain significantly challenged, particularly in the aftermath of the Boko Haram insurgency. The insurgency

led to widespread destruction of educational infrastructure, displacement of students and teachers, and the disruption of academic activities (UNESCO, 2021). Given these disruptions, the integration and effectiveness of E-learning tools in polytechnics require urgent investigation.

Despite the global shift towards digital learning, polytechnics in the region struggle with inadequate access to E-learning tools such as interactive software, digital simulations, and online platforms aligned for mathematics education. Factors such as poor electricity supply, internet connectivity issues, lack of digital literacy among educators and students, and limited government investment exacerbate these challenges (Adebayo and Salisu, 2020). The effectiveness of E-learning tools in enhancing mathematical comprehension is well-documented (Gikandi et al., 2011), yet their usability in North East Nigerian polytechnics remains uncertain due to these socio-economic and infrastructural barriers. Furthermore, the psychological and socio-economic aftermath of the Boko Haram insurgency has affected students' ability to adapt to technology-driven learning methods (Ojo and Akande, 2025). Many students and lecturers still rely on traditional teaching methods, which may not adequately equip them with the necessary skills required in today's technologically advanced world. There is a gap in empirical research exploring how these challenges impact the usability of E-learning tools for mathematics education in the region's polytechnics. Therefore, this study seeks to examine the availability and usability of E-learning tools for mathematics instruction in North East Nigerian polytechnics.

Objectives of the Study

The main of the study was to examine the availability and usability of E-learning tools for teaching and learning of mathematics in North East Nigerian polytechnics. Specifically, the objectives are:

1. To assess the Availability of E-Learning Tools for teaching and learning of mathematics courses in polytechnics of north east Nigeria during post Boko Haram insurgency.

2. To determine the Usability of E-Learning Tools for teaching and learning of mathematics courses in polytechnics of north east Nigeria during post Boko Haram insurgency.

Research Questions

The following research questions were raised and answered in the study:

1. To what extent are E-Learning tools available for the teaching and learning of mathematics courses in polytechnics of North East Nigeria during the post-Boko Haram insurgency?

2. How usable are E-Learning tools for the teaching and learning of mathematics courses in polytechnics of North East Nigeria during the post-Boko Haram insurgency?

Methodology

The study used descriptive survey research design as it is an effective method for investigating the availability and usability of electronic learning tools in teaching and learning mathematics in polytechnics in North-East Nigeria during the post-Boko Haram insurgency as the design allows researchers to systematically gather quantifiable data from a representative sample and analyze trends, patterns, and relationships within the educational sector. A descriptive survey research design is appropriate for studies that aim to systematically describe characteristics, behaviour, or conditions within a given population (Creswell, 2014 and Fraenkel et al, 2019). In relation to this study, a descriptive survey helped in assessing the availability and usability of electronic learning tools across multiple polytechnics, providing an accurate picture of the current educational technology status.

The population of the study consisted of all the students enrolled in the national diploma at twelve (12) polytechnics of North-East Nigeria that offered courses leading to the award of national diploma in 2024/2025 session. The target population of the study included both academic staff and students. Forty-Seven thousand, two hundred and eighty-nine (47,289) participants comprising of 3,020 academic staff and 44269 students from the twelve (12) polytechnics in North-East Nigeria represented the target population. The distribution of the Population was presented in Table 1 below:

Table 1: The distributions of Academic Staff and Students Population in polytechnics of North-east Nigeria

S/N	Name and Location of the polytechnic	Students Pop.	Lecturers Pop.	Total Pop.
1	Abubakar Tatari Ali Polytechnic Bauchi, Bauchi.	3,106	212	3,318
2	Adamawa State Polytechnic Yola, Adamawa	2,100	224	2,324
3	Federal Polytechnic Bali, Taraba	6,218	113	6,331
4	Federal Polytechnic Bauchi, Bauchi	9,137	335	9,472
5	Federal Polytechnic Damaturu, Yobe.	1,667	250	1,917
6	Federal Polytechnic Kaltungu, Gombe.	1,456	136	1,592
7	Federal Polytechnic Mubi, Adamawa	7,639	670	8,309
8	Federal Polytechnic Monguno, Borno	1,356	143	1,499
9	Gombe State Polytechnic Bajoga, Gombe.	2,430	112	2,542
10	Mai-Idris Aloama Polytechnic Geidam, Yobe.	523	103	626
11	Ramat Polytechnic Maiduguri, Borno.	3,946	503	4,449
12	Taraba State Polytechnic Jalingo, Taraba.	4,691	219	4,910
Grand Total		44,269	3,020	47,289

Grand Total	**44,269**	**3,020**	**47,289**

Source: Digest of Statistics of Technical, Vocational Education and Training (TVET) Institutions in Nigeria, 2024.

The sample of the study was selected using multi-stage sampling of stratified and simple random sampling techniques, stratified sampling is a probability sampling where researchers divide a heterogeneous population into distinct non –overlapping subgroups known as strata base on a specific characteristic and each stratum was then sampled independently, often using simple random sampling to ensure that the sample accurately reflect the populations' diversity. A sample of 381 participants comprising of 24 academic staff and 357 students from the twelve (12) polytechnics in North-East Nigeria that offered courses leading to the award of national diploma was used as suggested by the research advisor software for the survey research design and obtained by stratified sampling and simple random techniques. The sample was displayed in the table 2 below.

Table 2: The distributions of Academic Staff and Students Sample in polytechnics of North-east Nigeria

S/N	Name and Location of the polytechnic	Students Sample	Lecturers Sample	Total Sample
1	Abubakar Tatari Ali Polytechnic Bauchi, Bauchi.	25	2	27
2	Adamawa State Polytechnic Yola, Adamawa	18	1	19
3	Federal Polytechnic Bali, Taraba	50	1	51
4	Federal Polytechnic Bauchi, Bauchi	73	3	76
5	Federal Polytechnic Damaturu, Yobe.	13	2	15
6	Federal Polytechnic Kaltungu, Gombe.	12	1	13
7	Federal Polytechnic Mubi, Adamawa	62	5	67

8	Federal Polytechnic Monguno, Borno	11	1	12
9	Gombe State Polytechnic Bajoga, Gombe.	19	1	20
10	Mai-Idris Aloama Polytechnic Geidam, Yobe.	4	1	5
11	Ramat Polytechnic Maiduguri, Borno.	32	4	36
12	Taraba State Polytechnic Jalingo, Taraba.	38	2	40
Grand Total		**357**	**24**	**381**

Source: Research Field work, 2025

Instrument for data collection

Two instruments were adapted from Maccido *et al., 2024* and modified as Electronic-Learning Questionnaire for Students (ELQS) and Electronic-Learning Questionnaire for Academic Staff (ELQAS). It contained eleven (11) items and had two sections of A and B. Section A of the instruments deals with the e-learning tools availability, while Section B concerned with the e-learning tools usability. In Section A, the respondents are to tick the blanks where appropriate that best reflect his/ her opinion using four (4) points scale of Much Available (MA)=4, Available (A) =3, Few available (FA) =2, Not Available (NA)=1, likewise in Section B of the instruments the respondents are ask to tick the spaces where applicable that best reflect his/ her view using four (4) points scale of At Least Once Per Week (ALOPW)=4, Once Per Month (OPM) =3, Once Per Year (OPY) =2, Never (N)=1. These were used for data collection.

Validity of the Instruments

The face and content validity of the instruments (ELQS and ELQAS) was determined by given it to 3 experts for judgments in the Psychology, Guidance and Counseling Department, Faculty of Education, Sokoto State University, Sokoto State, Nigeria. These experts were given the copies of the instruments, topic of the study, aim and objectives and research questions as guide. Their comments were strictly used in the updated instrument.

Reliability of the Instrument

The measure of internal consistency of the ELQS and ELQAS was determined by administering them to 50 respondents made up 40 students and 10 academic staff in Umaru Ali Shinkafi Polytechnic Sokoto, Sokoto State. The reason for choosing Umaru Ali Shinkafi Polytechnic Sokoto, Sokoto State is the fact that the respondents have similar characteristics in all respect with the Polytechnics in North-East, Nigeria and it was determined by the split-half method and subjected to Cronbatch's Alpha and Kuder-Richardson formulas respectively, the value of 0.77 and 0.80 were obtained respectively and considered good for used in the study.

Procedure for Data Analysis

The data collected was analyzed via Statistical Package for Social Science (SPSS) version 24:0; Data was analyzed based on research questions and were answered by descriptive statistics of mean and standard deviation through using the mean criterion of 2.5 obtained from four points Likert scale as criteria for accepting or otherwise i.e. 4+3+2+1/4 = 2.5.

Results

Research Question One: To what extent are E-Learning tools available for the teaching and learning of mathematics courses in polytechnics of North-East Nigeria during the post-Boko Haram insurgency?

Table 3: Extent of E-Learning tools Availability for Mathematics Instruction in polytechnics of North-East Nigeria during the post-Boko Haram insurgency

S/N	E-Learning Tools	Much Available (F)	Available (F)	Fairly Available (F)	Not Available (F)	Mean	S.D
1	Scientific Calculator	145	135	58	43	2.90	0.95
2	Graphing Calculator	140	138	59	44	2.89	0.95
3	Computer System	128	104	85	64	2.68	1.04
4	Smart Board	137	140	60	44	2.86	0.95
5	Projectors	118	112	87	65	2.64	1.04
6	MAT LAB Software	28	50	173	130	1.87	0.84
7	Microsoft Excel	105	130	83	63	2.63	1.00

8	Python (with MAT Lesson)	82	75	128	95	2.29	1.04
9	Learning System Management platforms	72	48	149	112	2.13	1.03
10	Online Tutorial Platforms	63	59	149	111	2.19	0.98
11	Geogebra	98	113	97	72	2.53	1.02

Table 3 indicates that the extent of availability of Scientific Calculator for teaching and learning of mathematics courses in polytechnics of North East Nigeria during the post-Boko Haram insurgency respondents said it was available as the mean and standard deviation are 2.90 and 0.95. The respondents also indicated that Graphing Calculator, Computer System, Smart Board projectors and Microsoft excel were available respectively with 2.89 and 0.95, 2.68 and 1.04, 2.86 and 0.95, 2.64 and 1.04 and 2.63 and 1.00 of mean and standard deviation scores. More so, the data further revealed that MATLAB software; Python (with MAT lesson); Learning System Management platform and online tutorial platforms were the E-learning tools that were fairly available for mathematics instruction in polytechnics of North-East Nigeria as 50 % of the respondents indicated. The overall overview of data in table 3 shows that a lot of e-learning tools particularly hardware were readily available to respondents with pint-sized software ones at the polytechnics of North-East Nigeria.

Research Question Two: How usable are E-Learning tools for the teaching and learning of mathematics courses in polytechnics of North East Nigeria during the post-Boko Haram insurgency?

Table 4: Extent of E-Learning tools Usability for Mathematics Instruction in polytechnics of North East Nigeria during the post-Boko Haram insurgency

S/N	E-Learning Tools	Atleast Once Per Week(F)	Once Per Month (F)	Once Per Year (F)	Never (F)	Mean	S.D
1	Scientific Calculator	106	83	129	63	2.86	0.95
2	Graphing Calculator	155	129	55	42	2.94	0.95
3	Computer System	157	128	55	41	2.90	0.95
4	Smart Board	139	138	60	44	2.87	0.95

5	Projectors	187	111	47	36	3.06	0.94
6	MAT LAB Software	28	50	173	130	1.87	0.84
7	Microsoft Excel	138	139	60	44	2.86	0.95
8	Python (with MAT Lesson)	72	48	149	112	2.13	1.03
9	Learning Management System Platforms	66	51	151	113	2.18	1.00
10	Online Tutorial platforms	113	98	97	73	2.53	1.02
11	Geogebra	148	133	57	43	3.01	0.96

Data obtained from table 4 above highlighted the extent to which the usability of Scientific calculator for teaching and learning of mathematics courses in polytechnics of north east Nigeria during the Post Boko Haram insurgency, the respondents indicated it usable as the mean and standard deviation are 2.86 and 0.95 respectively. Furthermore, the respondents point out that, Graphing Calculator, Computer System, Smart Board, Projectors, Microsoft Excel Python (with MAT Lesson, Learning Management System Platforms, Online Tutorial Platforms, and Geogebra were usable respectively with 2.94 and 0.95; 2.90 and 0.95; 2.87 and 0.95; 3.06 and 0.94; 2.86 and 0.95 and 2.13 and 1.03; 2.18 and 1.00; 2.53 and 1.02 and 3.01 and 0.96 mean and standard deviation scores of Graphing Calculator, Computer System, Smart Board, Projectors, Microsoft Excel and Python with MAT Lesson), Learning Management System Platforms, Online Tutorial Platforms, and Geogebra respectively on the use of e-learning tools for mathematics teaching and learning in polytechnics of North-East Nigerian, which was above the 50% bench mark. Also, the respondents indicated that only the use of MAT LAB Software, Python (with MAT Lesson), was below the 50% bench mark.

Discussion

Out of the 11 vibrant e-learning tools for mathematics teaching and learning assigned as the criteria for the study, most were available in all the polytechnics within the sample, that displays that governments are aware of the importance of e-learning tools in building mathematics teaching and learning for learners' productivity (Gikandi et al., 2021). However, most of the polytechnics in North-east Nigeria were equipped with related mathematics e-learning tools, but the result indicated some polytechnics observed didn't use soft wares like MATLAB, Python, learning management platforms and online tutorial platforms in teaching and learning of

mathematics and this finding is in conformity of Maccido *et al*., 2024 and Nwachukwu et al. (2020). This non usability of the tools in the teaching and learning of mathematics in the polytechnics of North-East Nigeria portrays a neglect of some vital digital role of technology in mathematics instruction particularly during post Boko- Haram insurgency. There was an indication of full reliance on hard wares e-learning tools such as Scientific Calculator, Graphing Calculator, Computer System, Smart Board, Projectors and Geogebra. This was in line of Adebayo et al. (2023) and Yusuf and Balogun (2021) whose observed that, efforts have been made to rehabilitate educational infrastructure in the polytechnics, many institutions still struggle with limited resources and even where some polytechnics are privileged to have them, they were not used by the students and academic staff.

Conclusion

Mathematics is a science subject whose domain takes care of strengthening individual ability to reason rationally and thinks critically toward solving problems. Mathematics education is all about the development of the mind toward solving problems as a result of training or experiences received. Based on the findings, it can be concluded that some of the needed e-learning for teaching and learning of mathematics in polytechnics of North –East Nigeria were available. Additionally, the shortfall of inadequate use of the e-learning tools can be improved upon by providing steady power supply, suspending access policy and engaging mathematics teachers in a refresher training/ orientation in the use of digital tool particularly, the soft wares tools regularly through workshops/seminars.

Recommendations

1. Rectors, head of ICT units and Mathematics lecturers should try to consider and suspend accessibility policy in usage of Soft wares e-learning tools to enhance effective use of it in teaching and learning of mathematics courses during post Boko-Haram insurgency.

2. The government should ensure sufficient provision of significant and modern e-learning tools for effective teaching and learning of mathematics courses during post Boko-Haram insurgency.

3. There is urgent need for the organization of refresher training/orientation in the use of e-learning tools regularly through

workshops/seminars for Mathematics lecturers during post Boko-Haram insurgency.

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