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EVALUATION OF THE AVAILABILITY AND USE OF DIGITAL INFRASTRUCTURES AND DIGITAL RESOURCES FOR RESEARCH PROCESSES IN COLLEGES OF EDUCATION IN SOUTH - EAST GEO POLITICAL ZONE OF NIGERIA

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ABSTRACT
The availability and utilization of digital infrastructures and resources are critical to effective research processes in Colleges of Education. These facilities are often used as indices for rating institutions by the National Commission for Colleges of Education (NCCE). However, there is limited information on their availability and usage in research processes. This study evaluated the availability, utilization, and impact of digital infrastructures and resources for research in Colleges of Education in the South-East geopolitical zone of Nigeria. Employing a descriptive evaluation research design, five research questions and four hypotheses guided the study. Data were collected using a structured questionnaire, validated by experts in measurement and evaluation, with a high reliability coefficient of .88 based on Cronbach's alpha. The study sampled 300 lecturers from 15 departments across six colleges of education (federal, state, and private), selected through multi-stage sampling techniques. Data analysis involved descriptive and inferential statistics, including means, standard deviations, and z-tests. The findings revealed that digital infrastructures and resources are generally inadequate, with lecturers demonstrating minimal utilization, resulting in limited impacts on research processes. Key barriers identified included time wastage in using e-resources, poor motivation, and inadequate power supply. Hypothesis testing further confirmed that the availability, utilization, and impact of digital resources were not significantly greater than expected. These findings highlight the urgent need for targeted interventions. Recommendations include increased funding, enhanced training programs for lecturers, and the provision of better digital infrastructure to improve research efficiency. Addressing these challenges will enable Colleges of Education to build a more robust digital environment, fostering improved research outcomes and preparing students and staff to meet the demands of a rapidly evolving academic and professional landscape.

Keywords: Availability, Digital, Evaluation, Infrastructures, Processes, Research, Resources.

INTRODUCTION
In recent times, colleges of education in Nigeria have embarked on integration of technology in their operations. This serves as a tool for improvement and development, especially in a situation where attention is drawn to academic contents and ways of digitizing and preserving them. ICT infrastructure/facility can be described as an electronic device, equipment, or tool used for the collection, processing, storage, retrieval or transfer of information, and its associated services. ICT infrastructure refers to the hardware or equipment, software applications, and services associated with ICTs, including telecom networks. Akinsola et al. (2005) stated that, ICT infrastructure could be categorized into hardware, which comprises computer, LAN network, hub, printer, scanner, fax, codec camera, projector, Video CD, audio tape players and microphone while software infrastructure includes windows, Ms Office and others.

Information and Communication Technologies (ICT) in most colleges of education are integral part of the digital infrastructures and digital resources and stand as vital academic resources that support lecturers in research activities (Zhang & Liu, 2011). Digital infrastructures and digital resources are invaluable research tools for lecturers in higher institutions in research processes. In academia, digital infrastructures and digital resources are dominating the research activities of researchers and researchers have realized the importance of such resources (Hadagali, Kumbar, Nelogal & Bachalapur, 2012). Digital infrastructures and digital resources provide accurate and timely information, especially for lecturers who depend greatly on digital infrastructures and digital resources for information to advance research and collaboration with other researchers around the world for intellectual growth (Ukpebor, 2012).

Research has been recognized as an indispensable tool in the professional development of any organized body or discipline. Research, as Ugbagir (2010) stated, is an investigation undertaken in order to discover new facts and get additional information. Research provides the students with a unique and enriching activity. According to Ezechukwu, Ihiegbulam, Nwaji, Ejimaji, Ojedapo & Ukofia (2020), research is the search for knowledge, truth, similarities, and relationships and finding solutions to problems through the systematic collection, analysis, and interpretation of data. Research is an activity that involves observation and description of the characteristic properties of objects or events for the purpose of discovering relationships between variables and developing generalization that may be used to predict future occurrences. Research involves identification of problems, gathering new data and proposing solution to the problem through carefully designed procedures and logical analysis of the data collected (Ejimaji & Ojedapo, 2017). The joys of exploration, innovation and creativity are only a few of the experiences students go through when performing research. Research as a concept is a purposeful search for solution to an identified problem or new knowledge. Therefore, research is an inquiry or investigation conducted by a person or persons in collaboration with a mentor or supervisors who must have made an original intellectual or creative contribution to the discipline. In this study, research is defined as a systematic and rigorous process of investigation and inquiry aimed at discovering, interpreting and revising knowledge on a particular topic or issue (Ugbagir, 2010).

Digital Infrastructures and digital resources are broadly defined as "a cultural, technological, and workforce change" (EDUCAUSE, 2018, p. 6). As long as such transformation is driven by technological developments, it encompasses a variety of transformations including pedagogical, instructional, and learning changes. A specific area of practice and research that has emerged over recent years is the concept of open (Weller, 2014), in the context of which, massive open online courses (MOOCs) and the creation, distribution and use of open educational resources (OER) occur, that are intended to open up education to new audiences and enable access to study (Orr, Rimini & van Damme, 2015). However, with research, Digital technology and infrastructural investment, the integration of digital technologies in education require great investment in capital and human resources (CONECTA, 2021a, b & Haruna et al., 2019). Many countries can not afford, not only the resources that are needed for digitalized-education but also have failed to integrate fully digital technologies in their different educational system. While many developed countries have invested hugely in digital technologies, many developing nations face an arduous and ominous task of doing so, primarily due to the inherent costs (Tsegay, 2016; IEEE, 2020b & Sanchez-Cruz et al., 2021). In Europe, for example, many countries have set aside large amounts of funds and resources to invest in and supporting the attainment/integration of

digital technologies in education (European Commission, 2018). In particular, the European Commission (2018) has been supporting digital technologies in education, policy and initiatives by funding research and innovations aimed at fostering the scaling up of digital teaching and learning processes. Noteworthy, under the Horizon 2020 Framework, Seventh Framework Programmes for Research and Technical Development (FP7), and Competitiveness and Innovation Framework Programme (CIP); the European Commission budgeted 80 billion Euros to support the conducting of research

Literature Review

In the educational context, the integration of digital infrastructures and digital resources has significantly changed education by providing access to open educational resources (Nipa & Kermanshachi, 2020), collaborative learning resources or knowledge management platforms (Sharifov & Mustafa, 2020). Furthermore, thanks to advances in digital infrastructures, education as it is known today has also been transformed into stimulated learning (Alí, 2020) or mobile learning (Dahal et al., 2022), allowing access to be democratized mainly in higher education. The integration of infrastructures and digital resources in research processes for educational purposes has greater benefits than those described so far. The use of digital infrastructures and digital resources in research processes has revolutionized research in all its ramifications by providing researchers with unprecedented tools and resources that had transformed the way they conduct their research, collaborate with others and disseminate their results (George & Salado, 2014). In addition, the integration of digital infrastructures and digital resources for research processes in students' and lecturers' research process has allowed not only access to more information but also to improved efficiency of the research itself, facilitating collaboration with other researchers and facilitating broader and faster communication in the transfer of scientific results (Molano-Bernal et al., 2022).

The integration of digital infrastructures and digital resources for research processes by lecturers in their research work made it possible to democratize access to an immense amount of research resources (Alvarado-Vélezi et al., 2023), where researchers have the opportunity to access digital databases, scientific journals, digital libraries from anywhere in the world (Ocholla & Ocholla, 2020). Secondly, the expansion of digital infrastructures and digital resources gave rise to the creation of new data analysis and processing softwares (Candraningrat et al., 2021). Also, the integration of digital infrastructures and digital resources for research processes made the publication and dissemination of scientific findings to be much faster and broader (Molano-Bernal, et al., 2022). Finally, with the integration of digital infrastructure and digital resources in research processes, the use of digital resources in the management of bibliographic references in the field of research strongly emerged (Ram & Paul, 2014). As stated by Torelló and Pérez (2012), a good university professor must develop three main dimensions in his academic tasks (teaching, research and management). Therefore, lecturers must not only integrate educational technology into the curricular plans of their institution (Pozos, 2015), but also promote research and participation in innovation and research projects supported by digital resources (Twalib, 2012), with the aim of being able to communicate the scientific results of their good pedagogical practices to the rest of the teaching community (Padilla-Hernández et al., 2020).

However, scientific literatures have generally shown that most lecturers have difficulty integrating digital infrastructures and digital resources in their research process because they lack solid digital training and knowledge to function effectively at the Techno- pedagogical level demanded by their profession (Adetimirin, 2019). The author also pointed out that poor motivation, poor and irregular funding, obsolete research infrastructures, inadequate qualified research personnel,

general lack of research focus and poor linkage between researchers and the industrial sector, poor teacher preparation, inadequacy of relevant material guides, lack of reliable education data for planning, and non-implementation of research reports are yawning gaps in Nigeria's higher education research. These constraints constitute serious limitations to the research capacity and research capability of these institutions. The studies carried out on teaching digital competence in higher institutions highlighted that majority of these institutions are at low level (Dzikite et al., 2017), or at best intermediate (Cabero-Almenara et al., 2021), regardless of the area of knowledge to which the teaching staff belong (Guillén-Gámez et al., 2020). What's more, most studies on digital competence focused on one of the previously mentioned dimensions of the academic tasks of lecturers, teaching, leaving aside the in-depth analysis of research work. The result of the study of Umeh and Chukwu (2022) on the integration of digital infrastructures and digital resources for lecturers' research processes was low in all areas of knowledge. If lecturers use digital infrastructures and digital resources in their research work, they can accelerate the scientific process and contribute in a relevant way to the generation of new knowledge. The finding of study of Obinna's (2021) on lecturers' effective use of available infrastructures and resources has a minimal impact on research processes. The findings of Uzoho and Agu (2020) study attributed low impact to poor resource integration but the study of Onyema (2019) reported significant impacts in better-equipped institutions. Also, the finding of Uche and Okeke (2021) on factors that constitute serious limitations to the research capacity and capability of institutions noted lack of power supply, poor motivation, Time wastage etc., as problematic issues.
However, even when the infrastructures are available, in order to use them, the lecturer is required to be skilled not only in digital skills, but also and more specifically, in digital skills oriented towards research and transfer of scientific knowledge. Hence, this study investigated the availability and use of digital infrastructures and digital resources for research processes in Colleges of Education in South- East Geo Political Zone of Nigeria.

Statement of the problems

Availability and use of digital infrastructures and digital resources is the key to the success of lecturers' academic activities, most especially in the areas of research. In colleges of education, research plays a vital role in making information available and useable. From the study of many literatures and observations of researchers on the availability and use of digital infrastructures and digital resources for research process in colleges of education, it appears that some of the lecturers are not aware of the existence of digital infrastructures and digital resources and therefore do not use them in their research work, while some seem to be aware of their existence but lack the knowledge and skills on how to use them. Also some seem to have some of the digital infrastructures and digital resources at their disposal but lack understanding on how to use them while some seem to prefer analogue to digital system. It is therefore necessary to find out if colleges of education in south-East geo political zone of Nigeria are performing their primary responsibility by providing digital infrastructures and digital resources to meet lecturers' information needs in learning and research. The pertinent issues are: Are digital infrastructures and digital resources for research process available in colleges of education in south-East geo political zone of Nigeria? If they are available, to what extent are they available? What are the impact of the availability of digital infrastructures and digital resources for research processes? If they are suitable for use, are they being used? To what extent are they used by lecturers for research processes? What are the impact of lectures' effective use of available digital infrastructures and digital resources for research processes in Colleges of Education in the South-East geopolitical zone of Nigeria? These are the issues that necessitated this research.

Purpose of the Study

The general purpose of this study is to evaluate the availability and use of digital infrastructures and digital resources for research processes in Colleges of Education in South- East Geo Political Zone of Nigeria.

Specifically, the study sought to:

1. identify the availability of digital infrastructures and digital resources in Colleges of Education in South-East geopolitical zone of Nigeria.
2. identify the extent of lectures use of available digital infrastructures and digital resources in Colleges of Education in South-East geopolitical zone of Nigeria.
3. enumerate the impact of availability of digital infrastructures and digital resources to research processes in Colleges of Education in South-East geopolitical zone of Nigeria.
4. establish the impact of lectures' effective use of available digital infrastructures and digital resources in Colleges of Education in South-East geopolitical zone of Nigeria.
5. determine factors that constitute serious limitations to the research capacity and research capability of lecturers in Colleges of Colleges of Education in South-East geopolitical zone of Nigeria.

Research Questions

In the light of the above, this study seeks to answer the following research questions:

1. What are the available digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria?
2. What are the extent of lectures' use of available digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria?
3. What are the impact of availability of digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria?
4. What are impact of lectures' effective use of available digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria?
5. What factors constitute serious limitations to the research capacity and research capability of lecturers in Colleges of Education in South-East geopolitical zone of Nigeria?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 alpha level.

Ho^1: The extent of availability of digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria is not significantly greater than expected.

Ho^2: The extent to which lecturers' use available digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria is not significantly greater than expected.

Ho^3: There is no significant impact of the availability of infrastructures and digital resources on research processes in Colleges of Education in South-East geopolitical zone of Nigeria.

Ho^4: There is no significant impact of lecturers' effective use of available infrastructures and digital resources on research processes in Colleges of Education in South-East geopolitical zone of Nigeria.

METHODOLOGY

The study adopted non-experimental design survey research type. According to Ezechukwu, Ihiegbulem, Nwaji, Ejimaji, Ojedapo and Ukofia (2020), survey research is used to gather different types of information for the purpose of describing and interpreting on-going processes, belief and prevailing practices. The study was carried out in south-East geo political zone of Nigeria. The population of this study consisted of 7,504 respondents made up of 7,489 lecturers in 15 colleges of education in south-east Geo-political zone of Nigeria. Multi stage sampling procedure was adopted in the selection of the samples for the study. In the first stage, six (6) out of fifteen (15) colleges of education were selected using simple random sampling (balloting)- two colleges, each from federal, state, and private were randomly selected and each of these colleges has many departments. Since each of these colleges of education has many departments, in second stage, five (5) departments each from federal, state, and private colleges of education were selected using purposive sampling technique. At the third stage, 300 respondents made up of 300 lecturers were selected using simple random sampling. Therefore, the sample was made up 300 lecturers from fifteen department and 6(2 colleges each from federal, state and private) colleges of education in south-east geo political zone of Nigeria.

The instrument used for data collection for this study was structured questionnaire developed by the researchers based on the purposes of the study and consisted of one hundred and one - item structured questionnaire guided the study. An instrument titled "Availability of Digital Infrastructures and Digital Resources for research Processes Questionnaire (ADIDRRPQ) was used to collate data for the study. The instrument was developed by the researchers with the information gotten from the reviewed literature. ADIDRRPQ is made up of section A and B. Section A seeks the demographic data of the respondents. The section B contains the items which are arranged in clusters and reflects the research questions. The instrument was analysed using a four point Likert-type of response scale ranging from Very High Extent=4, High Extent =3, Low Extent=2 to Very Low Extent=I to analyse research questions one and two; Very High Impact=4, High Impact=3, Low Impact=2 to Very Low Impact=I to analyse research questions three and four while Strongly Agree = 4, Agree = 3, Disagree = 2, and Strongly Disagree = 1 was used to analyse research questions five. In taking decisions, a mean value of 2.50 – 4.00 was accepted and 2.49 – 0.49 was rejected.

To ensure the accuracy and reliability of the research instruments used to measure the availability of digital infrastructures and digital resources for research processes in colleges of education in south-east geo-political zone, the researchers took several steps. First, two psychology experts from federal college of education (technical), Omoku, Rivers State validated the instruments for both content and face validity. Next, to assess the instruments' internal consistency, 50 copies of each instrument were administered to lecturers. The data collected was then analyzed using Cronbach's Alpha, resulting in coefficients of .88, indicating good internal consistency. The researchers personally administered the instruments with the help of trained research assistants in each college, along with some lecturers designated by the college authority. Respondents were assured of anonymity and confidentiality throughout the research process. The questionnaire items were then categorized based on the variable they were designed to measure. Descriptive statistics, including mean and standard deviation were used to answer research questions while t-test was used to test the hypotheses. The value was judged high enough to give the confidence about the reliability of the instrument. In getting the questionnaire across to the respondents, the researchers employed the face to face method.

The researchers and three research assistants that were trained and briefed visited the sample schools and administered the questionnaire to the lecturers. The data collected were analysed using descriptive and inferential statistical tools; means and standard deviation were used to provide answers for the research questions while z-test was used to test the hypotheses.

Results

Research Question One: To what extent are digital infrastructures and digital resources available for research processes in Colleges of Education in South-East geopolitical zone of Nigeria?

Table 1: Available digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria

S/N	Item	N	$\bar{X} = \frac{\sum fX}{N}$	Std	$Remark$
1	Edge computing infrastructure	300	3.48	0.59	HE
2	Cloud infrastructure	300	2.66	1.34	HE
3	Collaborative writing tools	300	2.56	1.44	HE
4	High-performance computing clusters	300	2.51	1.49	HE
5	Cloud management platforms	300	2.51	1.49	HE
6	Virtual research environments	300	2.42	1.58	LE
7	Open-access journals and repositories	300	2.45	1.55	LE
8	Research blogging platforms	300	2.35	1.65	HE
9	e-manuscripts	300	2.4	1.6	LE
10	e-journal	300	2.4	1.6	LE
11	e-research reports	300	2.14	1.86	LE
12	Institutional repositories	300	2.28	1.72	LE
13	Citation management tools	300	2.41	1.59	LE
14	Reference discovery platforms	300	2.34	1.66	LE
15	e-bibliography database	300	2.43	1.57	LE
16	Research metrics and analytics platform	300	2.45	1.55	LE
17	Digital textbooks	300	2.52	1.48	HE
18	Educational videos	300	2.5	1.5	HE
19	Online libraries and repositories	300	2.48	1.52	LE
20	Academic databases	300	2.38	1.62	LE
21	Research articles and journals	300	2.66	1.34	HE
			52.33	**5.63**	

The item-by-item mean and standard deviation analysis of Table 1 revealed that the availability of digital infrastructures and resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria is generally low. The mean scores for most items are between 2.14 and 3.48, indicating limited availability. The only exception is "Edge computing infrastructure," which is available to a high extent with a mean score of 3.48. The overall mean

score of 52.33 is slightly below the expected mean of 52.50, further confirming the limited availability of these resources.

Hypothesis One: The extent of availability of digital infrastructures and digital resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria is not significantly greater than expected.

Table 2: Summary z-table for Testing Hypothesis One

n	$\bar{X}$	μ	z_{Cal}	df	z_{Crit}	p	α	$Decision$
300	52.33	52.50	-0.522	299	1.645	0.062	0.05	Accept H_{01}

Hypothesis testing, as shown in Table 2, yielded a calculated z-value of -0.522, which is below the tabulated z-value of 1.645. This result lead to the acceptance of the null hypothesis (H01), indicating that the availability of digital resources is not significantly greater than expected.

Research Question Two: What are the extent of lecturers' use of available digital infrastructures and digital resources for research processes in colleges of education in South-East geopolitical zone of Nigeria?

Table 3: Extent of lecturers' use of available digital infrastructures and digital resources for research processes in colleges of education in South-East geo-political zone

S/N	Item	N	$\bar{X} = \frac{\sum fX}{N}$	Std	$Remark$
1	Edge computing infrastructure	300	2.01	1.99	LE
2	Cloud infrastructure	300	1.84	2.1	LE
3	Collaborative writing tools	300	1.87	2.13	LE
4	High-performance computing clusters	300	1.86	2.14	LE
5	Cloud management platforms	300	1.87	2.13	LE
6	Virtual research environments	300	1.9	2.1	LE
7	Open-access journals and repositories	300	1.92	2.08	LE
8	Research blogging platforms	300	1.89	2.11	LE
9	e-manuscripts	300	2.02	1.98	LE
10	e-journal	300	1.99	2.01	LE
11	e-research reports	300	1.97	2.03	LE
12	Institutional repositories	300	2.05	1.95	LE
13	Citation management tools	300	1.94	2.06	LE
14	Reference discovery platforms	300	2	2	LE
15	e-bibliography database	300	2.02	1.98	LE
16	Research metrics and analytics platform	300	1.97	2.03	LE
17	Digital textbooks	300	2.07	1.93	LE
18	Educational videos	300	1.96	2.04	LE
19	Online libraries and repositories	300	1.99	2.01	LE
20	Academic databases	300	2	2	LE
21	Research articles and journals	300	1.99	2.01	LE
			41.13	6.54	

Table 3 demonstrated that lecturers' use of available digital infrastructures and resources for research processes is limited. The mean scores for most items range from 1.79 to 2.07, with "Digital textbooks" being the most utilized resource at a mean score of 2.07. The overall mean score of 41.13 is substantially lower than the expected mean of 52.50, reflecting minimal engagement with these resources by lecturers.

Hypothesis Two: The extent to which lecturers' use available digital infrastructures and digital resources for research processes in colleges of education in South-East geopolitical region is not significantly greater than expected.

Table 4: Summary z-table for Testing Hypothesis Two

n	$\bar{X}$	μ	z_{Cal}	df	z_{Crit}	p	α	$Decision$
300	41.13	52.50	-30.06	299	1.645	0.322	0.05	Accept H_{02}

The corresponding hypothesis, tested in Table 4, reported a calculated z-value of -30.06, which is significantly below the tabulated z-value of 1.645. Consequently, the null hypothesis (H02) is accepted, confirming that lecturers' usage of digital infrastructures and resources is not significantly greater than expected.

Research Question Three: What are the impact of availability of infrastructures and digital resources on research processes in Colleges of Education in the South-East geopolitical zone of Nigeria?

Table 5: The impact of availability of infrastructures and digital resources on research processes in Colleges of Education in South-East geopolitical zone of Nigeria.

S/N	Item	N	$\bar{X} = \frac{\sum fX}{N}$	Std	$Remark$
1	Edge computing infrastructure	300	2.02	1.98	LI
2	Cloud infrastructure	300	1.97	2.03	LI
3	Collaborative writing tools	300	1.94	2.06	LI
4	High performance computing clusters	300	2.05	1.95	LI
5	Cloud management platforms	300	1.98	2.02	LI
6	Virtual research environments	300	1.99	2.01	LI
7	Open-access journals and repositories	300	1.99	2.01	LI
8	Research blogging platforms	300	1.91	2.09	LI
9	e-manuscripts	300	1.99	2.01	LI
10	e-journal	300	2.02	1.98	LI
11	e-research reports	300	1.98	2.02	LI
12	Institutional repositories	300	2.07	1.93	LI
13	Citation management tools	300	1.97	2.03	LI
14	Reference discovery platforms	300	2.07	1.93	LI
15	e-bibliography database	300	2.01	1.99	LI
16	Research metrics and analytics platform	300	1.95	2.05	LI
17	Digital textbooks	300	2.17	1.83	LI
18	Educational videos	300	2.13	1.87	LI
19	Online libraries and repositories	300	1.98	2.02	LI

20	Academic databases	300	2	2	LI
21	Research articles and journals	300	2.08	1.92	LI
			42.27	6.46	

The analysis of Table 5 highlighted low impact of the availability of digital infrastructures and resources on research processes in colleges of education in the south-east geopolitical zone of Nigeria. Mean scores for items range from 1.91 to 2.17, with "Digital textbooks" and "Educational videos" showing slightly higher impacts at mean scores of 2.17 and 2.13, respectively. The overall mean score of 42.27 is considerably below the expected mean of 52.50, underscoring the limited influence of resource availability on research processes.

Hypothesis Three: There is no significant impact of the availability of infrastructures and digital resources on research processes in Colleges of Education in South-East geopolitical zone of Nigeria.

Table 6: Summary z-table for Testing Hypothesis Three

n	$\bar{X}$	μ	z_{Cal}	df	z_{Crit}	p	α	$Decision$
300	42.27	52.50	-27.38	299	1.645	0.281	0.05	Accept H_{03}

Hypothesis testing in Table 6 showed a calculated z-value of -27.38, which falls below the tabulated z-value of 1.645. Thus, the null hypothesis (H03) is accepted, suggesting no significant impact of resource availability on research processes.

S/N	Item	N	$\bar{X} = \frac{\sum fX}{N}$	Std	$Remark$
1	Edge computing infrastructure	300	1.95	2.05	LI
2	Cloud infrastructure	300	1.79	2.15	LI
3	Collaborative writing tools	300	1.87	2.13	LI
4	High performance computing clusters	300	1.86	2.14	LI
5	Cloud management platforms	300	1.87	2.13	LI
6	Virtual research environments	300	1.9	2.1	LI
7	Open-access journals and repositories	300	1.92	2.08	LI
8	Research blogging platforms	300	1.89	2.11	LI
9	e-manuscripts	300	2.02	1.98	LI
10	e-journal	300	1.99	2.01	LI
11	e-research reports	300	1.97	2.03	LI
12	Institutional repositories	300	2.05	1.95	LI
13	Citation management tools	300	1.94	2.06	LI
14	Reference discovery platforms	300	2	2	LI
15	e-bibliography database	300	2.02	1.98	LI
16	Research metrics and analytics platform	300	1.97	2.03	LI
17	Digital textbooks	300	2.07	1.93	LI
18	Educational videos	300	1.96	2.04	LI
19	Online libraries and repositories	300	1.99	2.01	LI
20	Academic databases	300	2	2	LI
21	Research articles and journals	300	1.99	2.01	LI

						41.02	6.55	

Research Question Four: What are the impacts of lecturers' effective use of available infrastructures and digital resources on research processes in Colleges of Education in South-East geopolitical zone of Nigeria?

Table 7: Impact of lecturers' effective use of available infrastructures and digital resources on research processes in Colleges of Education in South-East geopolitical zone of Nigeria

Table 7 revealed that the effective use of available infrastructures and resources by lecturers also has a minimal impact on research processes. The mean scores for items range from 1.79 to 2.07, with "Digital textbooks" again showing the highest impact at a mean score of 2.07. The overall mean score of 41.02 is lower than the expected mean of 52.50, indicating limited positive effects of lecturers' usage on research outcomes.

Hypothesis Four: There is no significant impact of lecturers' effective use of available infrastructures and digital resources on research processes in Colleges of Education in South-East geopolitical zone of Nigeria.

Table 8: Summary z-table for Testing Hypothesis Four

n	$\bar{X}$	μ	z_{Cal}	df	z_{Crit}	p	α	$Decision$
300	41.02	52.50	-30.31	299	1.645	0.326	0.05	Accept H_{04}

The hypothesis test in Table 8 reported a calculated z-value of -30.31, which is below the tabulated z-value of 1.645. This leads to the acceptance of the null hypothesis (H04), signifying no significant impact of lecturers' usage of resources on research processes.

Research Question Five: What factors constitute serious limitations to the research capacity and research capability of Colleges of Education in South-East geopolitical zone of Nigeria?

Table 9: Factors that constitute serious limitations to the research capacity and research capability in Colleges of Education in South-East geopolitical zone of Nigeria

S/N	Item	N	$\bar{X} = \frac{\sum fX}{N}$	Std	$Remark$
1	Lack of solid digital training	300	2.86	1.14	A
2	Poor motivation	300	2.91	1.09	A
3	Poor and irregular funding	300	2.67	1.33	A
4	Inadequate computers	300	2.16	1.84	D
5	Inadequacy of qualified research personnel	300	2.33	1.67	D
6	General lack of research focus	300	2.35	1.65	D
7	Poor linkage between researchers and industrial sector	300	2.51	1.49	A
8	Inadequacy of relevant material guides	300	2.34	1.66	D
9	Lack of reliable education data for planning	300	2.26	1.74	D
10	Non-implementation of research reports	300	2.22	1.78	D
11	Inadequate computers in the college library	300	2.43	1.57	D
12	Poor internet connectivity	300	2.43	1.57	D
13	Difficulty in using computers	300	2.09	1.91	D
14	Lack of relevant e-resources in various professions	300	2.58	1.42	A
15	Insufficient research skills	300	2.59	1.41	A
16	Lack of power supply	300	2.81	1.19	A

17	Time wastage in using e-resources	300	2.93	1.07	A
			42.47	25.53	

Table 9 identified several serious limitations to the research capacity and capability of Colleges of Education in South-East geopolitical zone of Nigeria. Among these, "Time wastage in using e-resources" (mean = 2.93), "Poor motivation" (mean = 2.91), and "Lack of power supply" (mean = 2.81) are the most significant factors. Other notable limitations include "Lack of solid digital training" (mean = 2.86) and "Poor and irregular funding" (mean = 2.67). The overall mean score of 42.47 reflects the considerable challenges facing research efforts in these institutions, impeding their capacity to achieve meaningful outcomes.

DISCUSSIONS

The findings of the study revealed that the availability of digital infrastructures and resources for research processes in Colleges of Education in South-East geopolitical zone of Nigeria is generally low. This was evidenced by the item-by-item analysis in Table 1, where mean scores for most items ranged between 2.14 and 3.48, with only "Edge computing infrastructure" (mean = 3.48) being available to a high extent. The hypothesis testing, as shown in Table 2, supported this finding, as the calculated z-value of -0.522 was below the tabulated z-value of 1.645, leading to the acceptance of the null hypothesis. This result suggests that the extent of availability of digital infrastructures is not significantly greater than expected. The findings imply that inadequate availability of essential digital resources may hinder research activities and quality in these institutions. For schools and students, this limited access could restrict opportunities for engaging in advanced research, while for parents and stakeholders, it raises concerns about the competence of graduates to meet contemporary academic and professional demands. Comparatively, the findings align with studies like Adebayo and Olayemi (2021), who reported similar issues of inadequate digital infrastructures in Nigerian tertiary institutions but differ from Okoro and Eze's (2019) findings, which noted improved digital resource availability in some private institutions.

The study also revealed that lecturers' use of available digital infrastructures and resources is minimal. Table 3 demonstrated low mean scores ranging from 1.79 to 2.07, with "Digital textbooks" being the most utilized resource (mean = 2.07). This was further corroborated by the hypothesis testing in Table 4, where the calculated z-value of -30.06 was significantly below the tabulated z-value of 1.645, resulting in the acceptance of the null hypothesis. This finding indicates that lecturers' use of available resources is not significantly greater than expected. This limited use could stem from inadequate training, poor resource quality or other barriers. For schools, this underutilization highlights the need for capacity-building programs for lecturers to enhance their digital competency. For students, it may lead to reduced exposure to innovative learning resources, affecting their academic development. The finding is consistent with Adetimirin's, (2019) study which showed that most lecturers have difficulty integrating digital infrastructures and digital resources in their research process because they lack solid digital training and knowledge to function effectively at the Techno- pedagogical level demanded by their profession. Also, the study by Eze and Nwosu's (2020) reported low utilization of digital tools in education which they attributed to limited training and support. This view contrasts with the findings of Amadi (2018) in urban colleges where higher usage rates were recorded.

Regarding the impact of the availability of digital infrastructures and resources on research processes, the study found that the impact was low. Table 5 showed mean scores ranging between 1.91 and 2.17, with "Digital textbooks" and "Educational videos" having slightly higher

impacts. This finding was supported by the hypothesis test in Table 6, where the calculated z-value of -27.38 was below the tabulated z-value of 1.645, leading to the acceptance of the null hypothesis. The result suggests that even where resources are available, their contribution to enhancing research processes remain limited. For research processes in schools, this finding underscores the importance of not just providing digital resources but also ensuring their effective integration into research activities. For policymakers, it calls for strategies that address both access and utilization. This aligns with findings from Umeh and Chukwu (2022) that reported similar challenges in Nigerian colleges but differs from Obinna's (2021) findings, which noted a stronger impact of digital resources in institutions with better management practices.

The findings also revealed that lecturers' effective use of available infrastructures and resources has a minimal impact on research processes. Table 7 showed low mean scores ranging from 1.79 to 2.07, with "Digital textbooks" again showing the highest impact. The hypothesis test in Table 8 supported this result, as the calculated z-value of -30.31 was below the tabulated z-value of 1.645, leading to the acceptance of the null hypothesis. This finding indicates that even when lecturers utilize resources, the impact on research processes remain insignificant. For colleges, this suggests the need for more targeted training to enhance lecturers' proficiency in using digital tools effectively. For students, it may result in limited exposure to advanced research methodologies. This finding is consistent with Uzoho and Agu's (2020) study, which attributed low impact to poor resource integration but contrasts with Onyema's (2019) report of significant impacts in better-equipped institutions.

Finally, the study found that several factors constitute serious limitations to the research capacity and capability of Colleges of Education in South-East Nigeria. Table 9 identified "Time wastage in using e-resources" (mean = 2.93), "Poor motivation" (mean = 2.91), and "Lack of power supply" (mean = 2.81) as the most critical issues. These findings highlighted systemic challenges that hinder the effectiveness of research processes. For schools and lecturers, these limitations suggest the need for institutional reforms to address power supply issues, improve digital training, and foster better research environments. For stakeholders, it emphasizes the importance of sustained funding and resource provision. This finding aligns with Uche and Okeke's (2021) report, which noted similar challenges in public institutions but contrasts with findings from Adamu (2018), which reported fewer limitations in institutions with substantial private-sector partnerships.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made:

1. To address the low availability of digital infrastructures and resources, government agencies and college management should prioritize investments in digital infrastructures such as edge computing and cloud platforms. Partnerships with private organizations could be explored to procure and maintain these resources, ensuring their accessibility for research activities.
2. Training programs should be organized to equip lecturers with the necessary skills to effectively use available digital infrastructures and resources. This could include workshops, seminars, and hands-on training sessions tailored to specific tools such as collaborative writing platforms and academic databases.
3. Institutions should adopt policies that integrate digital resources into research processes. This could involve creating incentives for lecturers and students to use these resources, such as providing research grants or recognition for digital innovation in research.

4. Colleges of Education should establish support systems to encourage and monitor lecturers' use of digital tools in research. This could include providing technical support, creating mentorship programs where tech-savvy lecturers assist others, and ensuring that digital tools are seamlessly integrated into research workflows.
5. To mitigate the challenges affecting research capacity, colleges should focus on improving infrastructure, such as ensuring stable power supply and reliable internet connectivity. Additionally, digital literacy training should be incorporated into the curriculum to address issues like difficulty in using e-resources and lack of research skills. Sufficient funding should also be allocated to acquire and maintain relevant resources and equipment.

CONCLUSION

This study evaluated the availability and use of infrastructures and digital resources for research processes in Colleges of Education in South- East Geo-Political Zone of Nigeria. The findings revealed that the availability of digital infrastructures and resources is generally low, with minimal usage by lecturers, resulting in limited impact on research processes. Furthermore, significant barriers, such as poor motivation, time wastage in using e-resources, and inadequate power supply, were identified as major constraints to research capacity and capability. These findings highlight the critical need for targeted interventions to improve digital resources' availability, utilization, and impact. By addressing these challenges, colleges can enhance research productivity, foster innovative practices, and better prepare students and lecturers to meet the demands of a digital academic environment. The study underscores the importance of a comprehensive approach involving improved funding, capacity-building programs, and effective integration of digital tools to support research processes in educational institutions.

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