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MODE OF UTILIZATION OF INFORMATION AND COMMUNICATION TECHNOLOGY RESOURCES FOR INSTRUCTIONAL DELIVERY IN UNIVERSITIES IN ADAMAWA STATE, NIGERIA

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Mode of utilization of information and communication technology resources for instructional delivery in universities in Adamawa State, Nigeria

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Abstract

This study examined basic ICT resources used for instructional delivery in Adamawa state, Nigeria. The study is quantitative research of a survey method. Different sampling techniques at different levels were used in selecting 214 lecturers from Modibbo Adama University of Technology (MAUTECH), Yola, Adamawa State University (ADSU), Mubi, and American University of Nigeria (AUN), Yola. Principles of Pedagogy-Space-Technology framework were considered in the research data gathering, and analysis. The findings revealed that there is a differential deployment in hardware, software and ICT resources across the three universities in Adamawa state. It was also discovered that lecturers perceived ICT to be useful for teaching, research, and social interaction. The study recommended among others that there should be more ICT resources, and competency training for lecturers of the institutions for effective awakening of the opportunities offered by ICT in the 21st Century.

Introduction

One of the awakening challenges and opportunities for 21st Century educators in Africa is in the use of technology in education. For instructors and educators to effectively design and deliver contents to their students, they must be willing to embrace technology. This approach creates opportunities for educators such as web-enabled face-to-face classroom, fully online classroom, smart classroom, blended options/hybrid interface, flipped classroom, and with broad concept, virtual learning environments, and so forth. However, in emergency (such as insecurity, lockdown, pandemic, strike action and so on), Emergency Remote Teaching (ERT) can be embraced with the use of digital technologies until the situation is over (Bates, 2016a). These opportunities were made with the advent of Information and Communication Technology (ICT) in education. ICT in education provides effective means of delivering instructional contents in a more systematic way.

With the emergence global pandemic (Covid-19), individuals, organizations and institutions are left with no other option but to fully embrace digital (online) collaborative tools for virtual meetings, virtual presentations, online conferences, webinars, and distance learning. The most used digital collaborative tools in this time of the pandemic include Zoom, Google Meet, Go To Webinar, Connectable, WebEx, Microsoft Teams, and Skype. These ICT resources have been used by instructors and educators for enhancing collaboration in teaching, research, and conferencing purposes especially in situation where physical gatherings are restricted, or Covid-19 policies are enforced by governments. Why these online collaborative tools became integrated in higher education institutions of most developing countries is because of ERT approach.

In Nigeria, quite several higher education institutions have adopted ERT approach during the post Covid-19 pandemic era by allowing their students continue with the ongoing 2019/2020 end of semester examinations or taking lectures remotely via digital technologies (ICT). This was followed with a directive from the Federal Government of Nigeria that all educational institutions in the country should teach their students via digital technologies, since schools were shut down due to the pandemic. Besides many confirmed cases of Covid-19 infections in Adamawa state of North-eastern Nigeria, it is also among insurgency-prone states, where several telecommunication masts were burnt down, and some students and lecturers became internally displaced by the activities of insurgents known as *Boko Haram*. In view of these problems, this study examined mode of utilization of ICT resources for instructional delivery in universities in Adamawa state, Nigeria.

Research Questions

This study aimed to examine ICT resources for instructional delivery in universities in Adamawa state, Nigeria. Specifically, answers were sought for the following research questions:

1. What are the available ICT resources for instruction in universities in Adamawa state?

2. What is the mode of utilization of ICT resources among lecturers in universities in Adamawa State?

Review of Related Literature

Digital technologies in education, or E-learning solutions are forms of ICT resources. The term ICT connotes several concepts such as a tool, a facility, resources, or a variety of goods, services and applications used for producing, distributing, processing, transforming information including telecoms, television, radio broadcasting, hardware and software, computer services, and electronic media (Marcelle, 2000). ICT has been conceived broadly as agglomeration of devices and functions such as radio, television, computers, scanners, printers, interactive/smart boards, data projectors, drives, video conferencing systems, modems, Internet, Wi-Fi, routers, voice over internet protocol, netbooks, games, satellite images, sensors, Electronic mail (Email), Global Positioning System (GPS), Personal Digital Assistant (PDA), and so on (Anderson, 2010). With the broad nature of ICT in whatever context, it can be classified into data capturing tools, data analytical tools, storage tools, interpretation tools, information transmission tools, and online collaborative tools.

In specific context, ICT for instructional delivery is the application of high-speed digital communication network, giving required information in education and services to schools, homes, offices and other relevant places (Musa, 2019; Levi & Okeke, 2006). In the 21st century teaching and learning process has shifted focus from teacher centered to learner centered approach, whereby instructors have opportunities to teach using multimedia (information provided in multiple formats e.g., text, audio, video, animations, graphics, and simulations, etc.) to meet up with diverse learning needs (Authors, 2018).

Taking a holistic view of ICT to encompass all the gadgets with their functions as well as the competency in using them to facilitate instruction, gives birth to the concept of ICT resources for instructional delivery. A competency in ICT refers to acquisition of relevant Knowledge, Skills and Attitudes (KSAs) that will enable an instructor, teacher, educator, or lecturer to effectively exploit ICT in education in general, or instructional delivery (Huang, Spector & Yang, 2019). Teachers and lecturers cannot utilize ICT effectively without the appropriate knowledge and skills, and a positive attitude towards ICT. If any of these constructs (KSAs) is not acquired, one can be termed incompetent in the utilization of ICT. Studies established that not much of digital technologies are used in pedagogical practice by educators in most Nigerian tertiary institutions owing to inadequate ICT resources in the institutions (Garba, Singh, Yusuf & Ziden, 2013; Agbatogun, 2006). This corroborated with the findings of Onasanya, Shehu, Oduwaiye and Shehu (2010) that most lecturers in Nigeria are not competent in the use of ICT for instruction, and that most ICT facilities for instructional delivery are not available in the institutions. The fact that most tertiary institutions in Nigeria have ICT infrastructure (in terms of buildings, offices, Internet connectivity, etc.), but it cannot guarantee adequacy of ICT resources.

Research has established that 76.5% of public universities in Nigeria do not have technical expertise and 69% had inadequate bandwidth (Aguele, 2007). In another research conducted in Lead City University (LCU) and University of Ibadan (UI) in Nigeria, Ojeniyi and Adetimirin (2013) revealed that ICT resources for instruction were available in the two universities, but LCU had more. The findings showed that the available ICT resources among teacher educators include computers, CD-ROM, printers, Internet, video tapes, audio tapes, and microphone, while other vital ICT resources like interactive whiteboard, multimedia projector, and ICT Resource Centre were either unavailable or not functioning in the institutions. It was reported that the challenge for lecturers is no longer in covering the course content, but in accessing ICT resources and using it for instructional purpose (Olaofe, 2005).

Ehikhamenor (2003) examined utilization of Internet facilities by Nigerian scientists in ten universities and found out that most of the scientists in the country still depend heavily on printed media for research activities, whereas World Bank (2002) recommended that in tertiary education reform, there should be electronic networking involving e-mail communication capabilities for teaching, learning, research management and performance monitoring of systems. Musa (2019) also corroborated that ICT resources facilitate research by both lecturers and students in universities in various ways. Reliable information and effective communication are important elements in the instructional process. Gambari, Fagbemi and Okoli (2010) expressed that the quality of instructional media employed by lecturers will enhance students' academic performance. It infers that available media utilized in a conducive environment will act as impetus to make university students productive to compete globally. Also, it was recommended from previous findings that availability of ICTs must be assessed for effective quality of instructional delivery (Idowu & Esere, 2013). This implies that ICT in education enhances lecture delivery, making quality research and enabling collaboration/interaction with students and colleagues.

For effective teaching in a digital age, several factors must be assessed (Bates, 2016b). These factors range from actual availability of technologies to perception of actors, who deploy, manage, and use technologies to enhance

instruction. It infers that universities in Nigeria could have ICT-designated units with some material and human resources, but the question is about relevance and effective utilization of the ICT resources for instructional delivery. With appropriate software, hardware and ICT infrastructure deployed in universities, lecturers are expected to use it to enhance their research, teaching methods, social skills development, and to collaborate with their counterparts across the globe.

Theoretical Framework

While investigating ICT resources for instructional delivery in terms of how instructors (lecturers) teach their students using technology, the Pedagogy-Space-Technology (PST) framework was considered in the study. The PST framework was considered appropriate for the study, because investigation into ICT resources for instructional delivery spins around the pedagogy used by instructors with their students, the medium of instruction (technology), and the learning space, which is being extended by technology (ICT), and several other connections (see Figure 1).

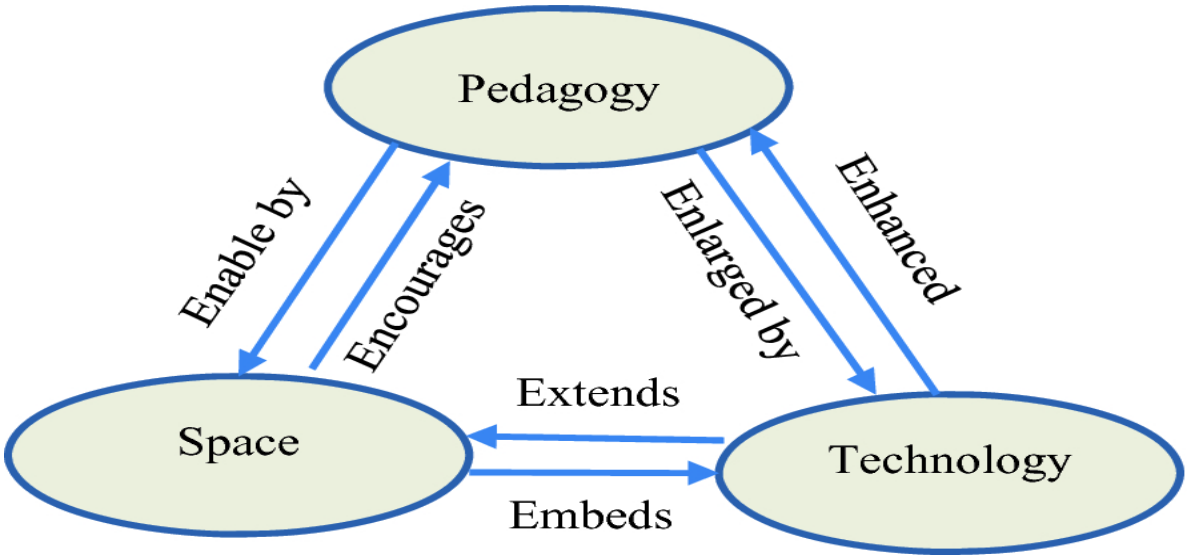

Figure 1: The Pedagogy-Space-Technology (PST) Framework
Source: Adopted from Huang et al. (2019). The image was retrieved from https://link.springer.com/chapter/10.1007/978-981-13-6643-7_9

The PST framework explains that there are inherent connections between instructional delivery (pedagogy), ICT (technology), and the design of learning space that create several other connections between instructors, learning content, learning space, and learners. The sequencing of items in the PST framework are very important, because each of the three elements in the framework influences each other in a reciprocal manner (Huang et al., 2019). The PST framework was proposed as planning principles for linking pedagogy with space (Fisher, 2005). Since then, the PST framework is considered as contribution of Fisher, and it is usually considered as the basis of Technological Pedagogical Content Knowledge (TPACK) framework. Unlike the context of TPACK as broad as infusion of innovations in curricular, the PST is aimed at creating principles for effective learning space design (Huang et al., 2019).

The PST is both a design, and an evaluation framework, and it provides principles (in Socratic, or questioning approach) for effective design and evaluation of pedagogy, learning space, and technology (Huang et al., 2019; Fisher, 2005). These principles have been categorized in life-cycle stages of focus, conception, and implementation and operation. Focusing on pedagogy, there is need to know (among other things) at the conception stage, what type(s) of learning and teaching are we trying to foster? Why is this likely to make a difference to learning? What is the theory and evidence? However, at the implementation and operation of the pedagogy questions to respond include the following among others: what evaluation methodology or approach was used to gather and analyze data? Who was included in the data gathering and analysis e.g., Students? Faculty? Administrators? Facilities managers and technology staff?

The term space in this framework represents environs, furniture, fittings, and learning environment. At a conception of space there is need to know among other things, what aspects of the design of space and provisioning

of furniture and fittings will foster instructional delivery? Who is involved in developing the design brief, and why? At the implementation and operation stage, there is need to evaluate, what aspects of the space design and equipment worked, and which did not, and why? The third important focus of this framework is technology, which represents ICT including laboratory, technicians, and equipment. At a conception stage, there is need to know what technology will be deployed to complement the space design in fostering the desired learning and teaching patterns, and how it would be done. To implement and operate technology (ICT), there is need to evaluate what technologies were most effective at enhancing learning and teaching, and why this is so? Given the complexity and challenges of designing effective learning space, the principles of PST framework were considering during construction, and administration of data collection tools for this study. Other aspects such as literature review for analyzing the problem, and generating empirical evidence was also guided by the PST framework. The principles of technology from this framework were also applied in conception and choice of ICT resources for this study. This led to categorizing ICT resources into hardware, software, and ICT infrastructure.

Methodology

This study adopted a quantitative research of cross-sectional survey design. This research design was deemed appropriate for the study of perceived mode of utilization of ICT resources for instructional delivery among lecturers in different universities. The population of the study comprised 4,292 full-time lecturers from three universities in Adamawa state. A total of 214 lecturers were sampled from the population based on prescription of Research Advisors (2006) model of determining sample size. The respondents were selected using stratified and proportionate random sampling techniques as shown in Table 1.

Table 1: Population and Sample of the Study

S/No.	School	Lecturers	Sample
1.	Modibbo Adama University of Technology (MAUTECH), Yola	3, 130	156
2.	Adamawa State University (ADSU), Mubi	870	43
3.	American University of Nigeria (AUN), Yola	292	15
	Total	**4, 292**	**214**

Source: Registry/Academic Units of the Universities.

The instrument, "ICT Availability Checklist" by Suleiman (2016) was used for data collection in this study. This checklist was a synthesis from the minimum standards of ICT by National Information Technology Development Agency (NITDA), Librarians' Registration Council of Nigeria (LRCN), and other relevant agencies in Nigeria (Suleiman, 2016). The checklist contained 15 items categorized into Hardware, Software and ICT Infrastructure across 6 levels: Quantity, Available, Not Available, Functioning, Not Functioning and Total.

The second instrument used for data collection in this study was a structured questionnaire for lecturers on mode of utilization of ICT resources for instruction developed by Suleiman (2016). The questionnaire contained 23 items across 4 points Likert scale of Strongly Agree, Agree, Disagree, and Strongly Disagree. The initial validation carried out on the two original instruments were considered appropriate for adoption in this study. The data collection exercise took place by the researchers via face-to-face contact with the respondents. The data collected were analyzed using descriptive statistics of frequency count and mean, which answered the research questions posed.

Results

The results obtained were presented in Tables 2 and 3 for the two research questions respectively.

Research Question 1: What are the available ICT resources for instruction in universities in Adamawa State?

Table 2: Available ICT Resources for Instructional Delivery

S/N	ICT Resources	MAUTECH 1	ADSU 2	AUN 3	Total
	HARDWARE				
1	Computer	45	115	610	770
2	Printer	5	5	305	315
3	Scanner	0	2	305	307
4	Photocopy machine	2	1	210	213
5	LCD Projector	10	2	100	112
6	Interactive whiteboard	0	6	0	6
	SOFTWARE				
7	MS Word	1	1	1	3
8	MS PowerPoint	1	1	1	3
9	MS Excel	1	1	1	3
10	SPSS	1	1	1	3
	INFRASTRUCTURE				
11	Internet bandwidth	45MBPS	25MBPS	150MBPS	220MBPS
12	Intranet	1	1	1	3
13	E-Library	1	1	1	3
14	ICT Lab/ICT Resource Centre	6	3	10	19
15	Learning Mgt. System/module	1	0	1	2

MBPS - means Micro bit per second.

Table 2 indicated basic ICT resources in terms of hardware, software, and ICT infrastructure available for teaching in Universities in Adamawa State. The result revealed that available ICT resources for instruction in the universities include 770 computers, 315 printers, 307 scanners, 213 photocopy machines, 112 projectors, 6 interactive whiteboards, 3 electronic libraries, and 19 ICT lab/ICT resource centres. Specifically, AUN had 610 computers, ADSU had 115 computers, followed by MAUTECH with 45 computers.

In terms of Internet bandwidth, AUN had the highest bandwidth (150 MBPS), followed by MAUTECH (45 MBPS), and ADSU (25 MBPS). The higher MBPS implies that the speed of browsing is quicker, and download rate is larger. However, the result further revealed that MAUTECH and AUN lacked interactive whiteboard for instruction, while ADSU lacked learning management system/module. From the three universities in Adamawa state, AUN had more of the basic ICT resources for instruction.

Research Question 2: What is the mode of utilization of ICT resources among lecturers?

Table 3: Mode of Utilization of ICT Resources among Lecturers

S/No.	Item Statements	SA	A	D	SD	Mean	Remark
1.	I design lecture presentation through slides in MS PowerPoint.	107	80	22	5	3.4	Accept
2.	I connect my computer with projector & other media.	106	82	23	3	3.4	Accept
3.	I print materials from networked printers.	90	94	23	7	3.2	Accept
4.	I use interactive whiteboard.	8	26	95	85	1.7	Reject
5.	I use Public Address System when students are many.	85	95	26	11	3.2	Accept
6.	I use wireless network or ICT lab/unit for Internet connectivity.	93	74	37	10	3.2	Accept
7.	I browse the Internet to get relevant materials.	119	68	23	4	3.4	Accept
8.	I give students Computer Based Test in ICT lab/ICT Resource Centre.	56	72	66	20	2.8	Accept
9.	I use photocopy machine to prepare and give students handouts or lecture materials.	150	36	22	6	3.5	Accept
10.	I use relevant storage devices to store relevant information obtained from Internet.	155	47	8	4	3.6	Accept
11.	I use automation tools for references, table of contents, list of figures & tables in my research report.	119	87	5	3	3.5	Accept
12.	I use simple editing tools e.g. bold, italics, centering, justify & fonts in typing my research report.	123	85	5	1	3.5	Accept
13.	I use Excel/SPSS and other software to analyze data.	136	71	6	1	3.6	Accept
14.	I use University E-Library to access online resources.	142	56	13	3	3.6	Accept
15.	I use online collaborative tools e.g. Zoom, Google Meet, Skype, etc.	157	46	5	6	3.7	Accept
16.	I join group chats in social media to receive and share information.	91	82	33	8	3.2	Accept
17.	I upload/download videos, images, and texts in social sites.	72	86	44	12	3.0	Accept
18.	I use social sites to post personal events, stories, & news.	69	92	46	7	3.0	Accept
19.	I use messenger apps to chat with different individuals.	8	52	81	73	1.9	Reject
20.	I use directorate of open access journals for research/publication.	165	44	4	1	3.7	Accept

Table 3 shows mode of utilization of ICT resources for instructional delivery among lecturers in the study area. The result revealed that most lecturers utilize ICT resources for teaching, research and social interaction, because mean score for most of the item statements was greater than 2.5 benchmark. However, the item statements 4 and 19 in the table were rejected, because the mean scores were greater than the benchmark of 2.5. Hence, most of the lecturers in the study area perceived ICT resources to be useful for teaching, research and social interaction. Utilization of ICT resources for instructional delivery among lecturers involves using ICT tools for teaching, research as well as interaction or collaboration in social media as perceived by lecturers in Adamawa state.

Discussion of Findings

This study has found out that there is a differential deployment in hardware, software, and ICT infrastructure among the three universities in Adamawa state in favour of AUN. This finding agreed with that of Ojeniyi and Adetimirin (2013), who reported that available ICT resources for instruction were more in a private university (Lead City University, Nigeria) than in a public university (University of Ibadan, Nigeria). This explained variation in availability of ICT resources for instruction even among different universities with different proprietorship. However, the findings of the current study nullified some previous findings by Aguele (2007), and Onasanya et al. (2010), who found out that most universities in Nigeria lacked ICT resources for instruction.

This study also found out that lecturers in Adamawa state perceived ICT resources to be useful for teaching, research, and social interaction. It implies that most of the lecturers utilized ICT resources for teaching, research, and social interaction. This is against most previous findings, which indicated that not much of digital technologies are used in pedagogical practice by lecturers in most Nigerian tertiary institutions (Garba et al., 2013; Agbatogun, 2006).

The second finding of this study is also in contrast with that of Onasanya et al, 2010 that most lecturers in Nigeria are not competent in the use of ICT for instruction. It is worth noting that effective utilization of ICT for instructional delivery is a function of competency, which is characterized by KSAs framework (Huang et al., 2019). Thus, for lecturers, teachers, or instructors to effectively utilize ICT for instructional delivery, they must possess knowledge and skills of ICT as well as positive attitudes (KSAs).

The findings from this study are in conformity with several studies that reported about the factors affecting ICT for instructional delivery such as teacher factor (e.g. attitudes), organizational factor (e.g. management, funding, etc.), availability factor (e.g. resources deployment), access factor (e.g. functionality issues), support service factor (e.g. manpower training, motivation), psychological factor (e.g. perception, interest, etc.) as well as social and environmental factors (Alade, 2006; Musa, 2019). The social and environmental factors may include issues of social distancing, lockdown, and so forth, which are prevalent during this Covid-19 pandemic. Generally, the discussion of findings has shown both opportunities and challenges of ICT for instruction in Nigeria with reference to availability and utilization of ICT resources amidst the incidence of Covid-19 and other emergencies.

Conclusions

The study concluded that with ICT resources in universities, lecturers and instructors can deliver effective instruction in a systematic way. However, it was discovered from this study that resource-gaps exist in ICT among lecturers and universities in Nigeria. These gaps generally manifest in the competency of ICT users especially for the purpose of instructional delivery. This is even though most lecturers are usually faced with unprecedented changes, with often larger lecture rooms, bigger halls, diverse students (including special students, digital natives, etc.), and above all, changing digital technology in education.

Schools closure directives by governments in Nigeria, and other policies associated with the global pandemic have taught institutions and individuals some lessons about the need to embrace digital resources. The PST framework, as used in this study will help learning institutions and lecturers in effective design and evaluation of learning space. The findings of this study pose implications on policy and practice of technology integration in higher education sub-sector in Nigeria.

Recommendations

From the forgoing discussions and the conclusions drawn, the following recommendations were made to guide policy and practice of ICT for instructional delivery in Nigeria:

1. There should be deployment of more ICT resources for instruction especially in the public universities in Adamawa state.
2. University lecturers and instructors in Adamawa state should be motivated to develop KSA framework of competency for effective utilization of ICT for instructional delivery.
3. There should be good maintenance culture for the available ICT resources for instruction in universities in Adamawa state. This will help to achieve sustainability of ICT resources in the institutions.
4. Regular training on ICT through workshop, webinar, and conferences should be organized for lecturers to motivate them in possessing appropriate KSAs for effective utilization of ICT resources for instructional delivery.
5. Beyond assumption, there is need for training of participants (educators, instructors, lecturers and students) on effective utilization of the commonly used digital collaborative tools e.g. Zoom, Google

Meet, Connectals, Microsoft Teams, etc. This will help to enhance effective adoption of ERT approach in higher education in Nigeria.

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