Prestige Journal of Education, Vol. 4, No. 1, June 2021
A publication of the Association for the Promotion of Innovation in Education (APIE)
ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

Deployment and Management of Technological Innovations by Distance Education Learners in Cross River State

Glory James Okon
Department of Continuing Education and Development Studies
University of Calabar, Calabar

James E. Okon, Ph.D
Department of Educational Management
University of Calabar, Calabar
drjameseokon777@gmail.com

Abstract
The extent of the deployment and management of three classes of technological innovations was the primary aim of this study. Four research questions were posed and answered in the study. The Cross-sectional survey research design was adopted for this study. The study targeted a population of 1,963 distance education students; however, a total of 1,017 distance education students were reached using the snowball sampling technique. Data for this study were collected from respondents using a rating scale tagged: "Technological Innovations Scale (TIS)." The scale was designed by the researchers, validated by experts and with acceptable psychometric properties (S-CVI = .79; Cronbach = .87). Findings showed that distance education students deployed Massive Open Online Courses (MOOCs) as well as Mobile Devices and Applications (MD&As) to a low extent; Open Education Resources were deployed to a high extent. There was a general low extent in the management of MOOCs, OERs and MD&As. There was a strong, positive and significant correlation between the deployment and management of technological innovations by distance education students. Based on these findings, conclusions, practical and research implications were discussed.
Keywords: deployment, distance, education, management, MOOCs, OERs.

Introduction
Traditionally, distance education refers to any teaching or learning process in which both the guidance and the subject are geographically apart. Students are not engaged in using physical instructional strategies as in conventional face-to-face situations. Distance education has been around for decades and involves collecting input from sources rather than traditional methods – such as working in institutions to gain experience. Some recent meanings have centred on it as a modern technological

advancement. This is because technological tools are required to bridge instructors and learners across remote locations. Distance education programmes have moved from the periphery to a major university education strategy and activity through spatial diffusion of ICT and a desire to provide lifelong learning opportunities (Kaliisa & Picard, 2017). The general definition of distance education usually includes the increase in enrollments, as well as, the use of ICTs to aid in teaching and learning (Mykhnenko, 2016). Moreover, the versatility and climate of distance education provide historically marginalized demographic groups with long-term opportunities to learn, including those who find it difficult to attend classes on a traditional university campus (Enoch & Soker, 2006).

Possible future learners, including functioning adults and women, have the opportunity to research in their room while staying devoted to their work and family commitments (Breines et al., 2019; McPheea & Pickren, 2017). Emerging innovations have been lauded as having the potential to change literacy, training, and learning. Nonetheless, there seems to be dearth of research on the opportunities presented by new technology in the field of online distance education. Often, academics, programmers, and educators describe how such systems can be used in face-to-face and hybrid courses, but not in distance education courses. Furthermore, distance education scholars and educators work in a variety of disciplinary fields, making it difficult to share and disseminate their work. As a result, pictures of how such innovations are used in distance education are questionable. Distance education (DE) indeed has the potential to provide high-quality higher education to geographically isolated and remote African students (Lembani et al., 2019); however, this potential may not be fully maximized without the support of information and communication resources.

Technological innovations are so important because they can be used to facilitate effective teaching, research and records management in higher education generally (Odigwe & Owan, 2020). Current trends in technological innovations that can be used in distance education programmes include Adaptive Learning (AL), Open Education Resources (OERs), Gamification and Game-Based Learning, Massive Open Online Courses (MOOCs), Learning Management Systems (LMS) and interoperability, Mobility and Mobile Devices, Blended Learning, Dashboards, Virtual Reality and Artificial Intelligence. These trends have been classified as primary and secondary trends; the first six are primary and the last three are secondary trends (Joosten et al., 2020). Distance education programmes in Cross River State and elsewhere, ought to ensure that students across remote locations have equal access to these innovations. Unfortunately, many studies tend to give the impression that there is an uneven distribution of ICT resources across diverse spaces, communities, and families (Bornman, 2015; Hill & Lawto, 2018; Pashapa & Rivett, 2017; Warf, 2019).

The digital divide in the access to ICT resources and service by students of distance education programmes may be addressed through their procurement, deployment and effective management. The argument is that, without effective procurement, deployment and management of technological devices or innovations (Ukpabio et al., 2020), distance education learners in Cross River State may not learn, function or perform as anticipated. There is a need for plans to be made on what technological innovations to be provided, in what quantity, by who, and when they should be fully operational for optimal utilization by distance education learners. Procured materials need to be put into use by learners through effective organization and coordination skills. Where necessary, training and retraining opportunities should be provided to distance education students on how to deploy these tools for a quality instructional process. This study was undertaken to assess the extent to which different technological innovations such as MOOCs, OERs and Mobile devices and applications are deployed and managed by distance education students in Cross River State, Nigeria.

Massive Open Online Courses (MOOCs) provide accessible and versatile means of learning new skills, promoting careers and delivering better education free of charge for everyone to participate through online courses. Although the majority of universities have discovered that MOOCs are not the answer to online education advancement, they still have a role in higher education, hopefully when more MOOCs are delivered as part of graduate degree programme (Joosten et al., 2020). They are being offered for a fee or tuition to satisfy the demands of increasing productivity or retraining the workforce in high-demand fields such as data science. Past studies have given attention to the extent to which MOOCs are available and utilized in higher education generally (e.g., Al-Imarah & Shields, 2019; Al-Imarah et al., 2021; Al-shami et al., 2018; Deng et al., 2019). Other studies have attempted to offer new innovative insights into the usefulness of MOOCs to the education sector (Annabi & Muller, 2016; Lee, 2020; Whitaker et al., 2016). The study of Lin and Cantoni (2018) focused on the decision on, implementation and confirmation of MOOCs in tourism and hospitality.

Little focus has been paid to the use of MOOCs in the context of distance education. Although most distance education programmes in Nigeria operate at the higher education level (which should make these cited studies relevant), the mode of operation and instruction in distance education institutions usually differ greatly from conventional higher education institutions such as universities, polytechnics and Colleges of Education. Furthermore, the cited studies constituted mostly of those from Asian countries. In Africa, particularly Nigeria, little is yet to be known about the deployment and management of MOOCs in higher education generally and in the context of distance education. African and Nigerian studies on MOOCs tend to explain

the importance of their leverage in promoting access and equity to education (Escher et al., 2021; Stephen & Molara, 2017; Yunusa et al., 2020); and the challenges facing their adoption (Abdulmajeed et al., 2020).

Open Educational Resources (OERs) are the substances of courses, resources or open events that teachers and students can conveniently access. They can be free or low cost, are mostly manufactured by members of the community rather than by publishers or sellers. In mainstream news and newspapers, and the DLI prize entries and winners, OER reveals itself as a trend particularly (Joosten et al., 2020). Faculty and institutional advocates agree that OER will help lower the cost of higher education for students as textbook alternatives. Many scholars and universities abandon expensive written alternatives for the textbook and go on to OER, notably in some courses like a gateway, fundamental or STEM-related courses (Joosten et al., 2020). Thus, the OER is introduced with the expectation that students' achievement will be favourably affected. Despite its popularity amongst honourees, there is not a lot of academic research out there with a focus on OER. Joosten et al. (2020) revealed that there is a journal ("International Review of Open and Distributed Learning Science"), focusing on publishing open-learning research with some academic research papers on OERs. However, Massive Open Online Courses (MOOCs) are nevertheless the main part of research published there in the last few years (Joosten et al., 2020).

Studies surrounding OER in Nigeria appears to be limited also. However, a study in South-Western Nigeria, using three distance learning institutions, showed an average extent of awareness and a high extent of utilisation of OER among students (Itasanmi, 2020). In Lagos State, the research of Onaifo (2016) found that participants had a constructive outlook toward OER in general, and learned from using the opportunities in a variety of ways; they were encouraged to use OER because the tools made it easier to complete assigned learning assignments; despite the advantages of OER, participants encountered several difficulties in using the resources, including the high cost of Internet connectivity. Based on the findings, an OER usage model was developed.

The research of Olufunke and Adegun (2014) found that undergraduates had a modest degree of knowledge about the supply and use of OER; some problems were encountered by undergraduates using OER, including erratic power supply, a lack of experience with OER portals, a university that was not linked to the internet, and a lack of knowledge about OER availability; using OER improved information exchange, course structure, access to quality learning resources, and the use of actual instructional materials online; however, there were several advantages of OER to undergraduates, including the exchange of global learning opportunities and the development of students' ability. Many other studies in the Northern and Western parts

of Nigeria abound on the utilisation of Open Educational Resources by students (Issa, et al., 2020; Zaid & Alabi, 2021). In the South-South region of Nigeria, particularly in Cross River State, studies on OERs seems to be non-existent to the best of the researchers' knowledge; with the present study appearing to be the first attempt. This study is important because there are a few distance education institutions in this region of the country; thus, there is a need to understand how these institutions are following global trends in the use of technology to enhance teaching and learning.

With respect to Mobile Devices and Applications (MD&As), Mobile devices are unconstrained devices that have wireless communications, including voice and data. Smart user generations are shifting from the prevalent 4th generation to 5G and next-generation broadband - the WiFi 6 (Joosten et al., 2020). Mobile devices can offer a diversity of experiences to students due to their rapid use, fast data speeds, and a large range of applications. Students' use of mobile devices to reach content, as well as, their anticipation of smooth interactivity, had a significant impact on digital learning (Joosten et al., 2020). Mobile devices and versatility are a prevalent theme, owing to the interactive applications of these innovations. About every student enters the school with one or more mobile devices. Many children use handheld devices for both amusement and education. The use of mobile devices by some demographic groups within universities and around the country is notable, and multiple surveys have identified mobile devices especially social media as a topic to follow (Erkollar & Oberer, 2013; Fleischmann, 2014; Mawere & Sai, 2018; Owan et al., 2020a; Owan & Robert, 2019; Yammine et al., 2018).

In addition, the use of courseware and key technology by students is affected by their use of mobile devices (Joosten et al., 2020). Thus, it is important to ensure the compatibility and functionality of portable devices for learning outcomes and fulfilment (Owan et al., 2020b). These arguments are supported by evidence such as what can be found in award submissions and selective academic journals (Joosten et al., 2020). Students at university often use electronic devices (e.g., smartphones and tablets), but programmers of online classes do not develop resources/courses with mobile learning in mind (Baldwin & Ching, 2020). The research of Chen, et al. (2020) revealed that the general worthiness of using mobile phones for language learning had a medium-to-high effect size of 0.722. The findings suggested that using a mobile phone to learn a language is more effective than using traditional methods.

A study conducted by Al-hunaiyyan et al. (2018) in Kuwait investigated the perception of students towards mobile learning. It was found that students and professors were very familiar with smart devices and their apps; students and teachers have favourable attitudes toward m-learning and that video-based social media apps are commonly used by them; certain social and cultural problems that can serve as roadblocks to m-

learning adoption were also revealed. Concerning the use of mobile devices, Andujar et al. (2020) revealed that participants indicated ease of use and emphasized the importance of designing the video content suitably, for a better mobile learning experience. The research of Becker et al. (2020) examined conceptual physics comprehension, cognitive load, and instructor behaviour using the mobile device and application strategy. Multilevel regression analysis showed that the approach significantly reduced alien cognitive stress and contributed to greater intellectual awareness.

In another research, it was found that collaborative education with mobile devices increased inspiration, interactions among students, student-to-student relationships, autonomy in learning, student-to-student pedagogical cooperation, and problem-solving; the time-span during training are primarily the tool for the teaching associated with mobile education (Costa et al., 2020). In Spain and at the secondary education level, the research of Gómez-García et al. (2020) showed a close association between educational centres and territories that allow the use of mobile devices in education and academic success. Although the approach that surrounds the use of smartphones as instructional tools is critical, the evidence gathered led to the belief that using cell phones in classrooms is a proposal that improved academic performance, regardless of the methodology utilized.

Notable efforts to adopting technological innovations in Nigeria have been recorded at the National Open University of Nigeria. It started with the establishment, of an OER unit in NOUN in August 2014, with a mandate for raising awareness of OER/MOOCs in NOUN and beyond, offering high-quality MOOCs and encouraging cooperation with other institutions. With MOOCs in NOUN, it is hoped that the issue of access and justice in education can be addressed without costs, as well as the consistency and level of acceptance of online education in Nigeria (Ikpe, 2018). Due to this development, the United Nations arranged a comprehensive, high-level workshop on OERs and MOOCs at National Open University of Nigeria (NOUN), to improve the quality and access to higher education of thousands of Nigerian and African students (UNESCO, 2019). The workshop was organized in the National Open University of Nigeria (NOUN) in Lagos (Nigeria), from 10 to 11 September 2014.

However, it is yet to be known the extent to which similar technologies have permeated other distance education programmes in Nigeria such as the National Teachers' Institute and those offered by the eleven universities currently approved to run open and distance learning (ODL) programmes. Information seems to also be lacking on the inclusiveness in the adoption of innovations in distance education even among different study centres of the National Open University of Nigeria. It was based on

these gaps that the present study was undertaken to provide answers to the underlisted questions.

Research questions

i. To what extent are MOOCs deployed and managed by distance education students in Cross River State?

ii. What is the extent of deployment and management of OERs by distance education students in Cross River State?

iii. To what extent do distance education students deploy and manage mobile devices and applications?

iv. What is the relationship between the deployment and management of MOOCs, OERs, and Mobile devices/applications?

Hypothesis

Ho1: There is no significant relationship between the deployment and management of MOOCs, OERs, and Mobile devices/applications

Methodology

The Cross-sectional survey research design was adopted for this study. The population comprised all the students of the National Open University and the National Teacher's Institute (NTI), Cross River State Study Centres. The population was narrowed to these two institutions because they are the ones popularly recognised and legally approved in the State to be offering distance education programmes. A total of 1,963 distance education students in both institutions were targeted. However, using the snowball sampling technique, the researchers were able to reach 1,017 of the students. This represented 51.8% of the targeted respondents. The data for this study were collected from these respondents using a rating scale tagged: "Technological Innovations Scale (TIS)." The scale was designed by the researchers and was structured into four sections. Section A was designed to collect demographic information of respondents such as age, gender, and marital status.

Section B, C and D of the TIS was designed to collect data on students' deployment and management of MOOCs, OERs and Mobile Devices/Applications. These sections had two sub-scales – one on the deployment of MOOCs, OERs and Mobile Devices respectively; the other was on the management of MOOCs, OERs and Mobile Devices accordingly. For the MOOCs (Section B), each sub-scale had a total of 15 items. The two sub-scales in section C (OERs) of the TIS was composed of seven items each. The two sub-scales in section D (MD&As) comprised 10 items respectively. All the items in section B, C and D had response options ranging from 0 (No deployment or management at all) to 5 (High extent of deployment or management).

Before administering copies of the instrument to the respondents, the instrument was validated by seven experts with ICV- indices ranging from .76 to .83 for the various items. The overall scale content validity index was .79. The instrument was trial tested for the reliability using the Cronbach Alpha approach. An overall score of .87 was obtained, revealing that the instrument was internally consistent for data collection. The instrument was administered to the respondents in stages. The researcher accidentally administered the copies of the instruments to some students who were available at the respective study centres at the time of data collection. Considering the irregular nature of distance learners, the first set of learners were pleaded to connect the researchers to other of their colleagues who were not available. Through these students, other students were reached and the network kept expanding as more students were reached. A total of 1,017 students were eventually reached and the data collected, were scored, coded and analysed using descriptive statistics and Pearson correlation matrix. The analysis of this study was aided by the use of the JASP (version 1.8.1) statistical application.

Presentation of results

Research question 1: To what extent are MOOCs deployed and managed by distance education students in Cross River State?

The first specific objective of this study was to determine the extent to which MOOCs are deployed and managed by distance education students in Cross River State. The result of the analysis using descriptive statistics and presented in Table 1, shows on a general note, that there is a low extent of deployment and management of Massive Open Online Courses (MOOCs) by distance education students in Cross River State. Specifically, there is a high rate in the deployment of Alison, Coursera and Udemy; whereas the other twelve MOOCs (Data Camp, Edu Open, Edx, FutureLearn, Kadenze, Lynda.com, MasterClass, Pluralsight, Saylor.org, Standford Open Edx, Swayam and Udacity) were deployed to a low extent. In terms of management, none of the specific MOOCs was managed to a high extent by distance education students. As shown in Table 1, only MOOCs whose mean values were greater than the 2.5 critical mean values, for both deployment and management, were considered as high extent.

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

Table 1: Extent of the deployment and management of MOOCs by distance education students in Cross River State

MOOCs	Deployment			Management		
	∑	Extent	Remark	∑	Extent	Remark
Alison	2604	2.56 ±1.70	HED	2085	2.05 ± 1.15	LEM
Coursera	2616	2.57 ± 1.65	HED	1901	1.87 ± 1.13	LEM
Data Camp	1232	1.21 ± 1.10	LED	1232	1.21 ± 1.10	LEM
Edu Open	1134	1.12 ± 1.08	LED	1134	1.12 ± 1.08	LEM
Edx	2519	2.48 ± 1.69	LED	2039	2.00 ± 1.18	LEM
FutureLearn	1026	1.01 ± 1.03	LED	997	.98 ± .96	LEM
Kadenze	1299	1.28 ± 1.22	LED	1231	1.21 ± 1.06	LEM
Lynda.com	2526	2.48 ± 1.71	LED	2025	1.99 ± 1.16	LEM
MasterClass	1120	1.10 ± 1.02	LED	1120	1.10 ± 1.02	LEM
Pluralsight	1146	1.13 ± 1.04	LED	1146	1.13 ± 1.04	LEM
Saylor.org	2612	2.57 ± 1.73	HED	2068	2.03 ± 1.16	LEM
Standford Open Edx	1028	1.01 ± .80	LED	1028	1.01 ± .80	LEM
Swayam	1143	1.12 ± 1.05	LED	1143	1.12 ± 1.05	LEM
Udacity	2489	2.45 ± 1.68	LED	2023	1.99 ± 1.15	LEM
Udemy	2572	2.53 ± 1.73	HED	1972	1.94 ± 1.14	LEM
Average	**1804**	**1.77 ± 1.35**	**LED**	**1543**	**1.52 ± 1.08**	**LEM**

μ = 2.50; HED = High extent of deployment; LED = Low extent of deployment; LEM = Low extent of management

Research question 2: What is the extent of deployment and management of OERs by distance education students in Cross River State?

The second specific objective of this study was to examine the extent of deployment and management of OERs by distance education students in Cross River State. Collected data were analysed using descriptive statistics and presented in Table 2. According to the results presented in Table 2, there is a high extent in the deployment of Open Educational Resources (OERs) by distance education students in Cross River State. However, there was generally, a low extent in the management of OERs by distance education students. In specific terms, the result in Table 2 indicates that all the OERs assessed in this study were deployed to a high extent without any exception. Despite the high extent of specific OERS, there was a high extent in the management of learning modules, open textbooks, and open courseware; while there was a low extent in the management of digital learning objects, online tutorials, open access journals and streaming videos.

Table 2: Extent of the deployment and management of OERs by distance education students in Cross River State

OERs	Deployment			Management		
	∑	Extent	Remark	∑	Extent	Remark
Digital learning objects	2743	2.70 ± 1.71	HED	2164	2.13±1.14	LEM
Learning modules	3252	3.20 ± 1.30	HED	2609	2.57 ± .86	HEM
Online tutorials	2649	2.60 ± 1.73	HED	2103	2.07 ± 1.17	LEM
Open access journals	2639	2.59 ± 1.70	HED	2108	2.07 ± 1.15	LEM
Open textbooks	3508	3.45 ± 1.49	HED	2650	2.61 ± .92	HEM
Open courseware	4167	4.10 ± 1.01	HED	2950	2.90 ± .30	HEM
Streaming video	3479	3.42 ± 1.87	HED	2391	2.35 ± 1.15	LEM
Average	**3205**	**3.15 ± 1.54**	**HED**	**2425**	**2.39 ± .96**	**LEM**

μ = 2.50; HED = High extent of deployment; HEM = High extent of management LEM = Low extent of management

Research question 3: To what extent do distance education students deploy and manage mobile devices and applications?

The third concern of this study was to determine the extent to which distance education students deploy and manage mobile devices and applications. The data collected were analysed using descriptive statistics and summarised in Table 3. Based on the evidence in Table 3, it was discovered that Mobile Devices and Applications (MD&As) were deployed and managed to a low extent on a general note. In specifics, the deployment of Edmodo, Kahoot, Laptops, SeeSaw, and Zoom was to a low extent; while the deployment of Moodle, Notebooks, Smartphones, Tablets and YouTube was to a high extent. Furthermore, the management of Edmodo, Kahoot, Laptops, Moodle, Notebooks, SeeSaw, Tablets, Zoom was to a low extent; while that of Smartphones and YouTube was to a high extent.

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

Table 3: Extent of the deployment and management of Mobile Devices and Applications by distance education students in Cross River State

MD&As	Deployment			Management		
	∑	Extent	Remark	∑	Extent	Remark
Edmodo	815	.80 ± 1.05	LED	765	.75 ± .90	LEM
Kahoot	1148	1.13 ± 1.07	LED	1148	1.13 ± 1.07	LEM
Laptops	2537	2.49 ± 1.70	LED	2033	2.00 ± 1.15	LEM
Moodle	2560	2.52 ± 1.73	HED	2020	1.99 ± 1.15	LEM
Notebooks	2577	2.53 ± 1.68	HED	2075	2.04 ± 1.13	LEM
SeeSaw	1186	1.17 ± 1.35	LED	1119	1.10 ± 1.21	LEM
Smartphones	3885	3.82 ± 1.09	HED	2863	2.82 ± .39	HEM
Tablets	2739	2.69 ± 1.49	HED	2223	2.19 ± .90	LEM
YouTube	3909	3.84 ± 1.077	HED	2876	2.83 ± .38	HEM
Zoom	2487	2.45 ± 1.715	LED	1990	1.96 ± 1.16	LEM
Average	**2384**	**2.34 ± 1.40**	**LED**	**1911**	**1.88 ± .94**	**LEM**

μ = 2.50; HED = High extent of deployment; LED = Low extent of deployment; HEM = High extent of management LEM = Low extent of management

Research question 4: What is the relationship between the deployment and management of MOOCs, OERs, and Mobile devices/applications?

Ho1: There is no significant relationship between the deployment and management of MOOCs, OERs, and Mobile devices/applications.

The fourth objective of this study was to examine the relationship between the deployment and management of MOOCs, OERs, and Mobile devices/applications. Pearson Correlation Matrix (PCM) was used to test for the nexus among the variables, but with a concern on the association between the deployment of MOOCs, OERs, and MD&As versus the management of MOOCs, OERs, and MD&As accordingly. The result of the analysis is summarised and presented in Table 4. Based on the result in Table 4, it was found that there was a strong, positive and significant relationship ($r = .91$, $p = .000$) between the deployment and management of MOOCs. A strong, positive and significant correlation ($r = .89$, $p = .000$) was also found between the deployment and management of OERs. It was discovered that the relationship between the deployment and management of MD&As was strong, positive and significant ($r = .91$, $p = .000$).

Table 4: Pearson correlation matrix of the relationship between the deployment and management of MOOCs, OERs and MD&As

Variables	$\bar{x}$	SD	(1)	(2)	(3)	(4)	(5)	(6)
(1) Deployment of MOOCs	26.61	5.41	1					
(2) Deployment of OERs	22.06	4.18	.06 .050	1				
(3) Deployment of MD&As	23.44	4.60	-.01 .812	-.01 .784	1			
(4) Management of MOOCs	22.76	4.14	.91** .000	.08** .007	-.02 .617	1		
(5) Management of OERs	16.69	2.72	.05 .110	.89** .000	-.02 .591	.076 .015	1	
(6) Management of MD&As	18.79	3.21	-.01 .777	.01 .811	.91** .000	-.01 .735	.01 .883	1

*** = correlation is significant at the .01 level
Note: Shaded cells are of major concern to the study

Discussion of the findings

It was discovered that distance education students deployed and managed MOOCs to a low extent respectively. Although some specific MOOCs were deployed to a considerable extent, the ratio to those deployed to a high extent, was not high enough. The finding is not surprising because, Nigeria, just like many other West African nations are considered as being technologically backward. Therefore, one possible reason for this finding may be students' low level of awareness of the presence and usefulness of MOOCs in supplementing distance education lesson contents. This explains why some studies, recently, have attempted to provide innovative insights into the usefulness of MOOCs to the education sector (Annabi & Muller, 2016; Lee, 2020; Whitaker et al., 2016). Some African and Nigerian studies on MOOCs tend to also explain the importance of their leverage in promoting access and equity to education (Escher et al., 2021; Stephen & Molara, 2017; Yunusa et al., 2020); and the challenges facing their adoption (Abdulmajeed et al., 2020). This suggests that the extent of deployment and management may witness a rise in the future as the level of awareness increases.

In terms of the deployment and management of Open Educational Resources (OERs), this study showed a general high extent of deployment, but a low extent of management. The result showed that many students in distance education institutions are utilising OERs to improve the quality of learning. One of the possible reasons for this high rate of deployment among students could be the adoption of some OERs by distance education programmes in Nigeria. For example, the National Open University of Nigeria was revealed to have adopted the OER model in providing distance

education to students. Such adoption could have created a high level of awareness among students. The management of these resources may have been low because the skills for effective management of these resources among students could be at the developmental stages, considering the time such innovations were integrated. This finding is consistent with the result of a study in South-Western Nigeria, which revealed an average extent of awareness and a high extent of utilisation of OER among students (Itasanmi, 2020). In line with the result of the present study, the research of Onaifo (2016) found that participants had a constructive outlook toward OER in general, and learned from using the opportunities in a variety of ways.

This study uncovered a low extent in both the deployment and management of Mobile Devices and applications by distance education students. This finding is quite surprising because, of the three classes of innovations studied, mobile devices and applications should be the most widely adopted. However, considering popular devices like smartphones, YouTube, Notebooks and others were deployed and managed to a great extent, the general low extent in deployment and management resulted from the presence of resources such as Edmodo, Kahoot, Laptops, SeeSaw and Zoom. These devices had a low extent of deployment and management perhaps due to students' low level of awareness of their existence or the high cost associated with the acquisition of such resources. For example, many students may not have deployed laptops because they do not own any, and to procure one, a high fee is required. This does not align with the position of past studies that the use of mobile devices by some demographic groups within universities is notable, and multiple surveys have identified mobile devices especially social media as a topic to follow (Erkollar & Oberer, 2013; Fleischmann, 2014; Mawere & Sai, 2018; Owan et al., 2020a; Owan & Robert, 2019; Yammine et al., 2018). The reason for result differences may also be due to the programming of most mobile devices which do not come equipped with educational resources. This agrees with the observation of a study that documented that programmers of online classes do not develop resources/courses with mobile learning in mind (Baldwin & Ching, 2020).

Lastly, this study discovered a strong, positive and significant relationship between the deployment and management of MOOCs, OERs and MD&As. This implies that high/effective deployment of these resources is associated with high/effective management and vice versa. This finding has implications for distance education learners because to effectively manage something, it presupposes that such a thing must have been procured, fully deployed and explored. It is in the deployment and exploration that skills may be developed, through experience, to handle materials for optimal performance and longevity.

The present study faces a few limitations in scope, in terms of the number of participants, geographical coverage and variables. The researchers could not study all the variables associated with technological innovations in distance education from a broader perspective. Notwithstanding these shortcomings, it is suggested that future related studies should aim at a broader perspective and incorporate more variables of technological innovations.

Conclusion

The study was designed to examine the extent to which technological innovations are being deployed and managed by distance education students in Cross River State. Three specific technological innovations were of interest to the researchers – MOOCs, OERs and MD&As. Quantitative data were collected and analysed using appropriate statistical methods. Based on the findings of this study, it was concluded that distance education students are yet to fully deploy technological innovations in supplementing lesson contents. The management of technological innovations among distance education students is generally low. Given that most of the innovations are relatively new, the level of deployment and management of technological innovations such as MOOCs, OERs and Mobile devices and applications is likely going to rise in the future. The study has implications for research and practice. Distance education students and coordinators have a role to play in improving the rate of adoption, deployment and management of technological innovations. This study has also been able to provide groundwork for future related researches to be built for a better understanding of the permeation of technology into the Nigerian Education system generally and/or her distance education programmes specifically.

Recommendations

Based on the findings of the study, it is recommended that:

i. Parents contribute more to the education of their children/wards by providing them with state-of-the-art mobile electronic gadgets, fully equipped with educational contents for quality learning.

ii. Students should ensure that they spend quality time deploying available gadgets, applications and devices to ensure that there is a full and optimal use of such resources for effective learning.

iii. The management of distance education institutions should ensure that students are trained by experts on how to deploy and manage technological resources that have been adopted and implemented into programmes.

iv. The government at all levels, as well as private individuals and Non-governmental organisations should support distance education institutions by making supplies or donations towards the provision of current technology for effective teaching and learning.

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

References

Abdulmajeed, K., Joyner, D. A., & McManus, C. (2020). *Challenges of online learning in Nigeria.* Proceedings of the Seventh ACM Conference on Learning (pp. 417–420). https://doi.org/10.1145/3386527.3405953

Al-hunaiyyan, A., Alhajri, R. A., & Al-sharhan, S. (2018). Perceptions and challenges of mobile learning in Kuwait. *Journal of King Saud University - Computer and Information Sciences*, *30*(2), 279–289. https://doi.org/10.1016/j.jksuci.2016.12.001

Al-Imarah, A. A. & Shields, R. (2019). MOOCs, disruptive innovation and the future of higher education: Conceptual analysis. *Innovations in Education and Teaching International*, *56*(3), 258-269. https://doi.org/10.1080/14703297.2018.1443828

Al-Imarah, A. A., Shields, R. & Kamm, R. (2021). Quality in higher education: Is quality assurance compatible with technological innovation? Case studies of massive open online courses (MOOCs) in the United Kingdom higher education. *Quality in Higher Education*, 1–16. https://doi.org/10.1080/13538322.2021.1830474

Al-shami, S. A., Aziz, H. & Rashid, N. (2018). The adoption of MOOC utilization among undergraduate students in Universiti Teknikal Malaysia Melaka (UTEM). *Journal of Fundamental and Applied Sciences*, *10*(6S), 2634-2654.

Andujar, A., Salaberri-Ramiro, M. S., & Martínez, M. S. C. (2020). Integrating flipped foreign language learning through mobile devices: Technology acceptance and flipped learning experience. *Sustainability*, *12*, 1110. https://doi.org/10.3390/su12031110

Annabi, C. A. & Muller, M. (2016). Learning from the adoption of MOOCs in two international branch campuses in the UAE. *Journal of Studies in International Education*, *20*(3), 260–281. https://doi.org/10.1177/1028315315622023

Baldwin, S. J., & Ching, Y. H. (2020). Guidelines for designing online courses for mobile devices. *TechTrends*, *64***,** 413–422. https://doi.org/10.1007/s11528-019-00463-6

Becker, S., Klein, P., Gößling, A., & Kuhn, J. (2020). Using mobile devices to enhance inquiry-based learning processes. *Learning and Instruction*, *69*, 101350. https://doi.org/10.1016/j.learninstruc.2020.101350

Bornman, E. (2015). Information society and digital divide in South Africa: Results of longitudinal surveys. *Information, Communication & Society*, *19*(2), 264-278. https://doi.org/10.1080/1369118X.2015.1065285

Breines, M. R., Raghuram, P. & Gunter, A. (2019). Infrastructures of immobility: Enabling international distance education students in Africa not to move. *Mobilities*, *14*(4), 484-499. https://doi.org/10.1080/17450101.2019.1618565

Chen, Z., Chen, W., Jia, J., & An, H. (2020). The effects of using mobile devices on language learning: a meta-analysis. *Education Tech Research Dev*, *68*, 1769–1789 https://doi.org/10.1007/s11423-020-09801-5

Costa, R. S., Medrano, M. M., & Lafarga, P. (2020). How to teach pre-service teachers to make a didactic program? The collaborative learning associated with mobile devices. *Sustainability*, *3755*. https://doi.org/10.3390/su12093755

Deng, R., Benckendorff, P. & Gannaway, D. (2019). Progress and new directions for teaching and learning in MOOCs. *Computers & Education*, *129*, 48-60. https://doi.org/10.1016/j.compedu.2018.10.019

Enoch, Y. & Soker, Z. (2006). Age, gender, ethnicity and the digital divide: University students' use of web-based instruction. *Open Learning*, *21*(2), 99-110. https://doi.org/10.1080/02680510600713045

Erkollar, A., & Oberer, B. J. (2013). Putting Google+ to the test: Assessing outcomes for student collaboration, engagement and success in Higher Education. *Procedia - Social and Behavioral Sciences*, *83*, 185–189. https://doi.org/10.1016/j.sbspro.2013.06.036

Escher, G., Noukakis, D., & Aebischer, P. (2021). Boosting higher education in Africa through shared massive open online courses (MOOCs). *International Development Policy*, *5*, Article 1790. https://doi.org/10.4000/poldev.1790

Fleischmann, K. (2014). Collaboration through Flickr & Skype: Can Web 2.0 technology substitute the traditional design studio in higher design education? *Contemporary Educational Technology*, *5*(1), 39–52. https://doi.org/10.30935/cedtech/6114

Gómez-García, M., Soto-Varela, R., Morón-Marchena, J. A., & Pino-Espejo, M. J. del. (2020). Using mobile devices for educational purposes in compulsory secondary education to improve students' learning achievements. *Sustainability*, *12*, 3724. https://doi.org/10.3390/su12093724

Hill, C. & Lawto, W. (2018). Universities, the digital divide and global inequality. *Journal of Higher Education Policy and Management*, *40*(6), 598-610. https://doi.org/10.1080/1360080X.2018.1531211

Ikpe, A. (2018). The Massive Open Online Courses (MOOCs) Initiative of the National Open University of Nigeria. *West African Journal of Open and Flexible Learning*, *7*(1), 163-180. https://wajofel.org/index.php/wajofel/article/view/26

Issa, A. I., Ibrahim, M. A., Onojah, A. O., & Onojah, A. A. (2020). Undergraduates' attitude towards the utilization of open educational resources for learning. *International Journal of Technology in Education and Science (IJTES)*, *4*(3), 227-234. https://doi.org/10.46328/ijtes.v4i3.105

Itasanmi, S. A. (2020). OER Awareness and usage among open and distance learning students in South-Western Nigeria. *International Journal of Indonesian Education and Teaching*, *4*(2), 343-357. https://doi.org/10.24071/ijiet.2020.040216

Joosten, T., Lee-McCarthy, K., Harness, L., & Paulus, R. (2020). *Digital learning innovations trends*. Online Learning Consortium: Every Learner Everywhere project of WCET.

Kaliisa, R., & Picard, M. (2017). A systematic review on mobile learning in higher education: The African perspective. *The Turkish Online Journal of Educational Technology*, *16*(1), 1-18.

Lee, K. (2020). Openness and innovation in online higher education: A historical review of the two discourses. *Open Learning: The Journal of Open, Distance and e-Learning*, 1–21. https://doi.org/10.1080/02680513.2020.1713737

Lembani, R., Gunter, A., Breines, M., & Dalu, M. T. B. (2019). The same course, different access : the digital divide between urban and rural distance education students in South Africa. *Journal of Geography in Higher Education*, *44*(1), 1–15. https://doi.org/10.1080/03098265.2019.1694876

Lin, J., & Cantoni, L. (2018). Decision, implementation, and confirmation: Experiences of instructors behind tourism and hospitality MOOCs. *International Review of Research in Open and Distance Learning*, *19(*1), 275–293. https://doi.org/10.19173/irrodl.v19i1.3402

Mawere, T., & Sai, K. O. S. (2018). An investigation on e-resource utilisation among university students in a developing country: A case of Great Zimbabwe University. *SA Journal of Information Management*, *20*(1), 1–7. https://doi.org/10.4102/sajim.v20i1.860

McPheea, S. & Pickren, G. (2017). Blended learning with international students: A multiliteracies approach. *Journal of Geography in Higher Education*, *41*(3), 418-433. https://doi.org/10.1080/03098265.2017.1331208

Mykhnenko, V. (2016). Cui bono? On the relative merits of technology-enhanced learning and teaching in higher education. *Journal of Geography in Higher Education*, *40*(4), 585-607. https://doi.org/10.1080/03098265.2016.1217832

Odigwe, F. N. & Owan, V. J. (2020). Academic staff personal variables and utilization of ICT resources for research, teaching and records management in higher education. *Proceedings of the 8th Annual European Conference on Education (ECE, 2020)*, 107–123. https://bit.ly/2GG36II

Olufunke, A. C., & Adegun, O. A. (2014). Utilization of open educational resources (OER) and quality assurance in universities in Nigeria. *European Scientific Journal*, *10*(7), 535-543.

Onaifo, D. (2016). *Alternate academy: Investigating the use of open educational resources by students at the University of Lagos in Nigeria.* Electronic Thesis and Dissertation Repository. 4086. https://ir.lib.uwo.ca/etd/4086

Owan, V. J., & Robert, I. A. (2019). Analysis of the utilization of social media platforms and university students' attitudes towards academic activities in Cross River State, Nigeria. *Prestige Journal of Education*, *2*(1), 1–15. https://doi.org/10.5281/zenodo.4458693

Owan, V. J., Bassey, B. A., Omorobi, G. O., & Esuong, U. U. (2020b). Poll everywhere e-learning platform, test anxiety, and undergraduates' academic performance in Mathematics: Empirical evidence from Nigeria. *American Journal of Social Sciences and Humanities*, *5*(1), 141–150. https://doi.org/10.20448/801.51.141.150

Owan, V. J., Ekpe, M. B., & Eneje, S. (2020a). Undergraduates' utilisation of social networking media and sexual behaviours in higher education: A case study. *Pedagogical Research*, *5*(2), em0062. https://doi.org/10.29333/pr/7940

Pashapa, T. & Rivett, U. (2017). Gender of household head and the digital divide in South Africa's settlements. *Gender, Technology and Development*, *21*(3), 232-249. https://doi.org/10.1080/09718524.2018.1434994

Stephen, O. K., & Molara, O. L. (2017). Massive open online courses among Nigerian postgraduate students: Fad or reality? *European Journal of Education Studies*, *3*(7), 569-575. http://doi.org/10.5281/zenodo.831158

Ukpabio, G. E., Ekanem, E. E., Mbon, U. F. & Arop, F. O. (2020). Administrators' awareness, procurement and management of virtual laboratories for teaching Science subjects in secondary schools: A case study. *The Journal of Social Sciences Research*, *6*(65), 598–605. https://doi.org/10.32861/jssr.65.598.605

UNESCO (2019). *Massive Open Education Opportunities at the National Open University of Nigeria*. https://en.unesco.org/news/massive-open-education-opportunities-national-open-university-nigeria

Warf, B. (2019). Teaching digital divides. *Journal of Geography*, *118*(2), 77-87. https://doi.org/10.1080/00221341.2018.1518990

Whitaker, J., New, J. R. & Ireland, R. D. (2016). MOOCs and the online delivery of business education: What's new? What's not? What now? *Academy of Management Learning and Education*, *15*, 345–365. https://doi.org/10.5465/amle.2013.0021

Yammine, S. Z., Liu, C., Jarreau, P. B., & Coe, I. R. (2018). Social media for social change in science. *Science*, *360*(6385), 162 LP – 163. https://doi.org/10.1126/science.aat7303

ISSN: 2645-324X (Print)
ISSN: 2645-3223 (Online)

Yunusa, A. A., Umar, I. N., & Ussher, J. (2020). *Leveraging massive open online courses (MOOCs) for increased access and quality education in Nigeria.* The 6th Asian Conference on Education and International Development (ACEID 2020), held at Toshi Hotel Tokyo, Japan.

Zaid, Y. A., & Alabi, A. O. (2021). Sustaining open educational resources (OER) initiatives in Nigerian Universities. *Open Learning: The Journal of Open, Distance and e-Learning*, *36*(2), 181-197. https://doi.org/10.1080/02680513.2020.1713738