



Digitizing distance learning materials: Measuring students' readiness and intended challenges

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Abstract

This study sought to explore distance education students' readiness to use digital learning materials from a College of Distance Education programme which was in the process of transforming the face to face approach of delivery to a more digitized one in Ghana. Using a descriptive survey design, 400 distance learning students were randomly sampled to respond to a 14-item questionnaire. However, 306 students duly responded and completed the questionnaire on their readiness to use digital tools, their access to digital technologies and the internet as well as challenges they envisage to confront in using digitized learning materials. The results revealed that majority of the students affirmed their readiness to use digital learning materials for learning. While respondents of the study did not report high access levels of some digital technologies such as tablets/iPad, desktop computers and laptops, majority of the students had personal access to smartphones with internet capabilities. Thus, the study highlights the potential of mobile phone device usage in distance learning and contends that in the midst of challenges bothering on access levels and high cost of internet, distance education institutions can operate the policy on bring-your-own-device (BYOD) in which distance learners make use of their personally owned devices to access digital content to support their learning.

Keywords Digital learning content · Distance education · Students readiness · Digital readiness · Mobile learning

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1 Introduction

Digital and emerging technologies have not only transformed the way we live, receive information, deliver services and products, but have also impacted the way learning occurs (Soomro et al., 2018). In the current information society, people have to access knowledge via information and communication technology (ICTs) to be abreast with the latest developments (Talebian et al., 2014). The rapid adoption of Internet-based services, wireless technologies and the convergence of previously distinct ICTs such as broadcasting, computing and communication contribute to the rapid socio-economic development of the country. The electronic and the emerging technologies have also widened the frontiers of distance education. All over the world, distance education is being utilized to make access to high education simple, flexible and cheaper. It is recognized as a tool to make higher education accessible to the unreached and to allow a large portion of the population to participate in education (Kwapong, 2009).

In Ghana, there has been a significant increase in the number of distance education provisions over the past ten years. This is due to several interventions and initiatives put in place by various governments. Most of such initiatives are enshrined in policy documents, including the Ghana Information and Communication Technology for Accelerated Development (ICT4AD) Policy (Republic of Ghana, 2003), the National Telecom Policy (NTP), ICT in Education Policy (Republic of Ghana, 2008). Also, other strategic plans have been enacted to provide strong pathways to the achievement of these policies. Examples are the Education Strategic Plan (ESP) 2003–2015 and the fifth Education Strategic Plan (ESP) 2010–2020 which focused on four areas: Access to Education, Quality of Education, Education Management Science, Technology, Technical and Vocational Education and Training.

Although the ultimate aim of these policies is to transform the country from the agro-based economy into an information-rich and knowledge-based economy and societies using the tools of ICT, these initiatives also provide a conducive environment for the deployment of ICT at all level of education and, particularly, in distance education to enhance teaching and learning at the tertiary level. Following these policies, a number of Institutions in the country have initiated programmes that employ emerging technologies to widen access to higher education which has become a general and perennial problem in Ghana.

The College of Distance Education of the University of Coast has been at the forefront of these initiatives. The College seeks to increase access to higher education and also address higher education needs of adults by delivering quality education to reach students in the remote areas of the country. The College has put measures in place to explore the potentials of ICT in its distance learning delivery by digitizing the paper-based learning materials. The aim is to make learning materials easily accessible, reach out to the underprivileged and also extend its services beyond the borders of Ghana. There is no doubt that such initiatives have the propensity to improve student-teacher interactions and reduce the cost of running distance education programmes. Learners are believed to be more technology savvy and adaptable to changing technology (Awadhiya et al. 2014; Miglani and Awadhiya (2017). While the developments in new and emerging technologies provide direct access of resources to students, factors such as students access to technology resources, infrastructure issues and readiness to adopt technologies still remain matters of great concern (Agyei & Voogt, 2015;

Esterhuyse & Scholtz, 2015). The ever-increasing cost of internet data coupled with poor connectivity continues to pose problems for technology adoption in developing countries (ITU, 2017).

The current study therefore seeks to explore students' readiness to use digitized learning materials and the anticipated challenges they may encounter with its deployment, access and use. Specifically, the study sought to address the following objectives: a) assess distance students' access to digital technologies; b) determine the students' readiness to use digital learning materials; and c) identify students anticipated challenges of the use of digital learning materials.

2 Digitization, ICT and distance education

Digitization, ICTs and distance education have a point of convergence. In the past two decades, it has become increasingly difficult to decouple distance learning and information and communication technologies. The internet and the emerging technologies have acted as a conduit through which knowledge is transmitted to the learner. As a result, terms such as eLearning, distance education, online learning are being used interchangeably. Digitization can be said to be a product of ICT, and the main tool for teaching and learning delivery. A number of attempts have been made at defining the term digitization. According to Witten and David (2003), digitalization (of study materials) is the process of taking print-based materials in the form of books and papers and converting them to the electronic form, where they can be manipulated and stored by computer. In the view of Lovasz (2014), digitization of material can be regarded as a system, which manages a collection of digital information resources. Fabunmi (2006) simplifies the meaning of digitization by stating that, it is the process in which materials are converted from the hard copies to electronic copies. It must be noted that digitization does not only mean scanning, but also involve simple data conversion from catalogue cards or paper to digital form; videos and audios, images or picture, portal document format (pdf), and word processing format. Peter and Deimann (2013) emphasized that the presence of digitization have attracted individuals, to opt for the alternative modes of educational delivery such as distance electronic learning (e-learning) and distance education. This is due to the flexibility of these modes of education delivery. Digitization in this context refers to the conversion of the existing hardcopy learning materials and other processes to digital formats and making them available through digital means. E-learning, on the other hand, involves the conduct of teaching and learning through digital means or the Internet. The former is said to be a subset of the later, however, the two are used interchangeably. This study hypothesizes that the advantages of e-learning compared to traditional course delivery include flexibility, accessibility and convenience for students, cost and time savings for educational establishments, and the ease and speed with which courses can be updated and revised. This is what the College of Distance Education programme at the University of Cape Coast seeks to achieve. The College, is one of the main colleges at University of Cape Coast with the mandate of making the University's programmes available, flexible and accessible especially to workers through the distance mode of delivery. The College has a population close to 50,000 students and 86 study centres spread in all the regions in the country. The College runs both undergraduate and

postgraduate programmes with specializations in education and business. About 13,000 graduates are churned out every year with degrees and diplomas. The needs of the distant learner are rightly served through the provision of varied market-driven programmes which offer the learners the opportunity to choose programmes that best suit their interests. Students converge at their study centres every fortnight to attend face-to-face tutorial sessions with the help of course tutors. The main study materials for the face-to-face has been the printed modules. However, the College is in the process of transforming the face to face approach to a more digitized approach of delivery. This situates the relevance of the study as it is purposed to explore students' readiness to use digital learning materials.

2.1 Digital readiness

To be able to use digitized learning materials means that learners should be digital ready. Several studies have focused on digital readiness with different lenses and from different viewpoints.

Dawn (2017) explained digital readiness to encompass two major components, digital literacy and digital citizen. Digital literacy according to Heitin (2017) specifically involves using technology to find and evaluate information, produce digital content, and share information with others while digital citizenship according to Ribble (2017) generally refers to the norms of appropriate and responsible use of technology. Du Toit as cited in van Zyl et al. (2013) rather preferred to refer to digital readiness as e-readiness and stated that it is the students' readiness to make use of ICT and eLearning within their studies which include how to access, evaluate and adapt resources for learning from the internet. In a study on readiness and perception of teachers on mobile learning in Open University in Asia, Miglani and Awadhiya (2017) assessed teachers' readiness to engage with technology on the bases of technological device availability (device readiness) and skills (skills readiness) to use the devices. Other factors considered under technology availability were the device's capability to access the internet and optimal screen. However, skill readiness was assessed based on the activities performed through mobile phones. The study found that 86% had access to technological devices with internet capability. Horrigan (2016) used Pew Research Center survey findings to explore the attitudes and behaviours that underpin people's preparedness and comfort in using digital tools for learning. Five main factors were used to assess the respondent's digital readiness: (1) confidence in using computers; (2) facility with getting new technology to work; (3) use of digital tools for learning; (4) ability to determine the trustworthiness of online information; and (5) familiarity with contemporary "education tech" terms. The study found that those who demonstrated a higher level of preparedness for using technology in learning are also portrayed above average on measures of digital readiness.

In a similar study, van Zyl, et al. (2013) studied open and distance learning (ODL) students' readiness to use digital technologies in their learning in South Africa. The study employed the UNESCO's (2002) developmental phases of ICT Implementation, Integration, and Use (IIIU) framework. The students' e-readiness was assessed by access to computers and the internet, computer literacy, learning with technology, mobile learning and educational digital versatile disks (DVDs). It was found that majority (76.3%) of the students had access to computers at home and at school/work. A few of the students had

access to the Internet at home (9.3%), and at school/work (29.9%). However, majority of students felt comfortable to use computers, and found it easy to type assignments on a computer. The study concluded that more students make use of the internet, with support from others than students who use the internet by themselves.

Readiness as conceptualized in this study adopted the definition by Miglani and Awadhiya (2017) to mean “the availability of capabilities and resources to perform a particular task that needs specialized skills and infrastructure” (p.59). Thus, the authors measured readiness by exploring 1) distance students’ access to digital technologies, 2) distance students’ access to internet and 3) whether distance students’ digital devices have internet capabilities. Thus, students’ readiness in this study involved the availability of capabilities and resources and the preparedness to perform a particular task that needs specialized skills and infrastructure, particularly, in relation to digital tools. Our ability to assess readiness will enable the College of Distance Education and similar institutions to effectively strategize the implementation of new learning systems to achieve optimum results.

2.2 Mobile technologies and digital content

One of the advantages of digital learning content is its potential to fit mobiles devices. Apart from the fact that digital formats could fit all kinds of digital and electronic devices such as desktop and laptop computers, the advent of new and emerging technologies including smartphones, tablets, phablets, iPads and so on, present a high level of optimism due to their mobile and ubiquitous nature. On account of this, Cheon et al. (2012) declared that integration of mobile learning (m-learning) in higher education delivery is particularly appropriate to foster student-centred learning due to the widespread use of mobile devices on college campuses. The United Nations Education, Scientific and Cultural Organisation (UNESCO) at the 2017 Mobile Learning Week in Paris, France, indicated that:

Mobile technology can also open doors to education, bringing learning to people where they are, preparing them for work, easing their integration into new communities, firing their imaginations, building resilience and illuminating routes from an uncertain present to more promising futures.

This suggests that the world is gradually moving from single position desktop fixed computers to easily carried mobile devices. Holzinger et al. (2005) in distinguishing between traditional eLearning and m-Learning stated that while the minimum hardware requirement for traditional eLearning is a personal computer such as notebooks, they do not provide total independence in location. However, mobile learning is considered as the next generation of eLearning that can fulfil the advantage of real independence in accessing learning materials wherever and whenever. Thus, they stressed that m-Learning will be an important instrument for lifelong learning. How well mobile technologies are being used to access digital content to support distance learner at the College of Distance Education in Ghana was one of the focus of this studies. The authors explored the participants’ readiness to use mobile devices to access digital learning content in order to ease access to learning materials.

2.3 Technological challenges

Many factors have been identified as impediments to technology adoption and utilization in developing countries compared to their developed counterparts. While challenges such as poor internet connectivity and access to digital devices are not considered as problems to contend with in many developed countries, they are matters of great concern to the developing world. For instance, in Tanzania, Mwakyausa and Mwalyagile (2016) conducted an empirical review of the impediments to technology adoption. The study identified lack of technological infrastructure such as lack of computers, low internet bandwidth, and low ICT-competence as the main impediments to technology adoption in higher learning institutions. Similarly, other studies also found challenges such as cost impediments including the cost of technology (Kisanga & Ireson, 2015); the cost of internet (Nyandara, 2012); and lack of funds to acquire digital tools (Nyandara, 2012; Kisanga & Ireson, 2015). In an exploratory study conducted to identify barriers to eLearning deployment in corporations in South Africa, Esterhuyse and Scholtz (2015) classified the challenges into four: personal; social interaction; assistance and external factors. They explained personal challenges as individuals' unwillingness and lack of desire to use e-learning system. Personal challenges tend to emanate from the e-learning participants rather than the system. Social interaction challenge involves lack of interaction between learners while instructor's inability to provide the needed assistance to learners creates frustrations. These challenges need to be identified and managed to minimize their impact on the effective use of digital content.

In this study, challenges learners at CoDE are likely to face in using the digitized learning materials were explored. Specifically, anticipated challenges such as access to internet, high cost of internet data, small screen size of mobile devices, and high cost of digital devices were explored. These challenges have the capacity to limit students' access to digital resources.

3 Methodology

The current study aimed at measuring students' readiness to use digitized learning materials and the associated anticipated challenges. A descriptive survey design was utilized. The choice of the design was informed by the type of research questions, purpose and the data collection instruments used in this study. As intimated by Glass and Hopkins, as cited in AECT (2001) descriptive research involves "gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection" (p.1). A survey, on the other hand, is basically a series of questions used to measure respondents' responses in a questionnaire. The study targeted all degree students in both business and education programmes and the postgraduate diploma in education (PGDE). This provides a total population of 13,765 students. Out of this number, a sample of 400 selected for the study was appropriate based on the Krejcie and Morgan's sample determination table as cited by the Research Advisors (2006). A 14-item questionnaire based on motivation from the research instrument of Miglani and Awadhiya (2017) was developed and used for the data collection. The questionnaire comprised 13 close-ended items and one open-ended item. Cronbach's alpha estimates

for the close-ended items of the instrument during a pilot-test yielded 0.69. This estimate is in line with Nunnally and Bernstein (1994) and Vaske's (2008) recommendation that reliability coefficients in the .65–.80 range are 'adequate' and acceptable. On the basis of that, the instrument was considered suitable for data collection. Descriptive statistics were used to analyse the data obtained from the close-ended items; frequency distributions were generated and the results were presented with tables and graphs. Data collected from the open-ended items were analysed using thematic analysis method proposed by Clarke and Braun (2013). The study achieved a return rate of 78.5% consisting 306 respondents. The respondents were made up of 188 males and 118 females with a mean age of 29 years. The respondents also comprised 262 bachelor's degree students and 44 postgraduate students spread across the various levels. Table 1 shows the summary of the demographic characteristics of the respondents.

4 Results

4.1 Students' readiness to use digital learning materials

With regard to the use of digitized learning materials, respondents were asked to indicate the extent to which they were ready to use them. They had to indicate one of these stages: (1) Not ready; (2) Somehow ready; (3) Very much ready. The scores were interpreted as follows: 1 is the lowest possible score, which represents a weak response of the students' readiness, while 3 is the highest possible score which represents a very strong positive readiness to use digitized learning materials. The study revealed that the overall mean score of 2.03 (SD = .806) indicates that the students were somehow ready to use digital learning materials.

The breakdown is shown in Table 2. The table shows that, more than 50% of the students (212, 69.3%) were ready to use the digital content. This number was made up of 107 (35.0%) students who were somehow ready and 105 (34.3%) who were very much ready. This was especially so for the bachelor's degree students; while 188 (71.8%) of them reported to be either ready or somehow ready, only 24 (54.5%) of the postgraduate diploma students were either very much ready or somehow ready for

Table 1 Demographic Data of the Respondents

Variable	Category	Mean/Frequency	%
Age		29.0	
Gender	Male	188	61.4
	Female	118	38.6
Programme	Bachelor's Degree	262	85.6
	Postgraduate Dip	44	14.4
Level	One	71	23.2
	Two	157	51.3
	Three	27	8.8
	Four	51	16.7

Table 2 Students Readiness to Use Digitized Learning Materials

Programme	Extent of readiness			Mean	SD
	not ready	somehow ready	very much ready		
Bachelor's Degree ($N = 262$)	74 (28.2%)	97 (37.0%)	91 (34.8%)	2.06	.792
Postgrad. Diploma ($N = 44$)	20 (45.5%)	10 (22.7%)	14(31.8%)	1.86	.878
Total ($N = 306$)	94 (30.7%)	107(35.0%)	105(34.3%)	2.03	.806

the digitized learning materials. Thus, more of the postgraduate diploma students (20, 45%) compared to bachelor's degree students (70, 28.2%) reported not being ready to use the digital learning materials.

Another way the study assessed students' readiness was in the distance students' levels of access to digital technologies. Respondents were asked to indicate whether or not they possessed certain digital devices to enhance their learning. The results are as presented in Table 3.

The results indicate that, majority of the respondents ($n = 251$, 82%) had access to smart phones specifically. This result appears favorable and seems to suggest that respondents can use their personally owned mobile phones to access digitized materials should CoDE deploy digitized learning materials in the distance learning programme. Access levels to other digital technologies reported were relatively low. The table also shows that 105 (34.3%) students had access to laptops, 34 (11.1%) had access to Tablets/ iPad while the least ($n = 26$, 8.5%) was reported on access to desktop computers. A few students ($n = 31$, 10.1%), however, had no access to any of the digital devices.

In addition to students' access to digital devices, results regarding students' devices with internet capability are presented in Fig. 1.

The results show that as many as 275 (89.9%) students had access to digital devices capable of accessing the internet while a few students 31(10.1%) had devices without internet capabilities. This seem to suggest that a good number of the students had devices that can be used to access digital learning materials from the internet.

This study also explored the challenges students envisage that could be associated with the use of digitized learning materials. Students' responses on these anticipated challenges *are* presented in Fig. 2.

Table 3 Distance Students' Access to Digital Technologies

Digital Device	Yes		No		Total	
	N	%	N	%	N	%
Smartphone	251	82.0	55.0	18.0	306	100
Tablets/iPad	34	11.1	272	88.9	306	100
Laptop	105	34.3	201	65.7	306	100
Desktop computer	26	8.5	280	91.5	306	100
None	31	10.1	275	89.9	306	100

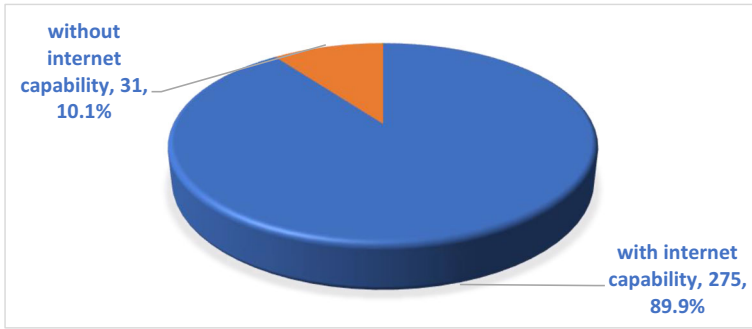


Fig. 1 Distribution of students' digital devices with or without internet capability

The highest rated (58.5%) anticipated challenge to accompany the use of digitized learning materials as reported by the distance students was the high cost of internet bundles. This was followed by a technological device battery problem (56.2%) and small screen size (54.2%). Lack of access to the internet (21.2%) was one of the least anticipated challenges indicated by the students, which was followed by other varied problems (4.8%).

The study also reported on the students' expectations of the institution to assist in the use of the digitized learning material. An open-ended item on the questionnaire was used to collect respondents' views on such expectations. The information reported was analyzed qualitatively using data reduction techniques in which major themes (provision of digital devices, provision of internet/data bundles, fostering implementation, etc.) were identified and clustered. The statements as reported by the respondents are summarized in Table 4.

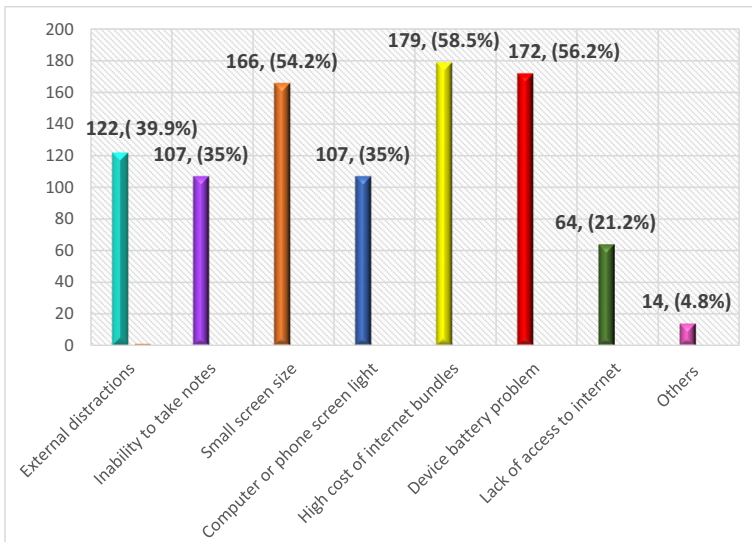


Fig. 2 Students Anticipated challenges of the Use of digitized learning materials

Table 4 Expectations of Students on the Institution's Use of Digitized Learning Materials

Theme	Sample Statements
Provision of digital devices	<ul style="list-style-type: none"> -I want them to provide us with the technological devices -Provide students with tablets and computers -Supply electronic gadgets to students free of charge and reduce high fees students pay -Supply Tablet -Laptops should be provided -I will love it if the institution can provide us with quality tablets/iPad -Laptops should be given to students -Tablets should be provided -They should provide Tablets & iPads at moderate prices and also liaise with internet providers to improve on the network connectivity -They should supply us with tablet -They should provide us with tablets that are in good conditions -Give us students tablets -Tablets or iPad should be provided since it has a broader screen -The institution should provide laptops on credit for those who don't have them. -They should provide students with large interface Samsung tablets -Help provide laptop computers -The institution should provide us with tablets or smartphones
Provision of Internet/data bundles	<ul style="list-style-type: none"> -Provide us with internet bundles -Give internet bundle freely -Provide data bundle -They should try and provide internet bundles to students -The institution should provide us with free data -Provide internet bundle and tablets with bigger screens
Implementation Enhancement	<ul style="list-style-type: none"> -Bring it as fast as possible -It must come very early -It must come early -If implemented, updates should be done regularly to ensure smooth studies and should be available on the portal for easy access.

4.2 Provision of tablets/laptop computers

Provision of tablets to students was the most popular comment made by most of the students. This may be due to its large screen size and mobility. Majority of students (63%) indicated that the institution should provide tablets at an affordable cost and/or subsidized prices to aid students in order to enable them use the softcopies of learning materials. One of the most popular comments respondents made was: "I will like the institution to provide us with quality Tablets/Ipads". Similarly, other respondents simply declared the following comments: "*Laptop should be provided*", "*I want them to provide us with technological devices*", and "*The institution should provide us with tablets or smartphones*". Such comments from the students suggest that they expect some support in the form of provision of digital devices to enable them use the digitized learning materials.

4.3 Data bundle/internet access

The second theme identified in the analysis of students' responses was the provision of internet data bundles. While some students just indicated that the institution should provide them with internet data bundles, others were quick to add that the bundles should be provided freely to students to enable them use the digital content effectively. The comments of the students included: "*They (the institution) should see to the data cost*" and "*Provide us with internet bundles either in cash or airtime*".

4.4 Enhancing implementation

Some students also commented that the provision of digital learning materials is long overdue and its implementation should not be delayed any longer. The respondents, therefore, indicated that the authorities should speed up the process of implementing the digitization of learning materials to make them easily accessible. These were some comments: "*Bring it as fast as possible*", "*It must come very early*" and "*It must come early*".

5 Discussion

The current study sought to measure distance learners' readiness to use digital learning materials. In the study, digital readiness was measured in the distance students' reported self-efficacies to use digital tools, their access to digital technologies and the internet as well as whether the digital devices they possess had internet capabilities. Distance learners' anticipated challenges as well as their expectations from the host institution in making use of digitized learning materials were also explored.

The respondents' reported self-efficacies showed that majority (more than 70%) of the students affirmed they were ready to use the digital learning materials. As reported in literature (Bandura as cited in Wu and Tsia, 2006), self-efficacy influences people's choice of activities, how much effort they will expend, and how long they will sustain efforts in dealing with stressful situations. Thus, indication of the respondents' readiness in this study is a demonstration of their self-perceived confidence and expectations of using digital learning content (Wu and Tsia, 2006). This seems to suggest that the positive response of readiness by majority of the respondents to use digital learning materials is significant and serves a positive and necessary benchmark for the institution to effectively strategize and deploy the implementation of new learning system. One possible reason that could explain the high levels of readiness perhaps is the respondents' comfort with technology use. This finding is in line with the study conducted by van Zyl et al. (2013) in South Africa. The study concluded that majority of students who took part in the study were e-ready because almost 71% felt comfortable to use computers, while 65.5% found easy to type assessments on a computer. Thus, the students' high levels of digital learning self-efficacy cannot be underestimated because it is a firm indication of their beliefs, convictions and motivation to use digital tools for learning (Bandura & Schunk; Betz & Hackett; Pajares & Miller as cited in Joo et al. 2000).

Another major indicator of digital readiness as reported in literature is the access to or availability of digital devices and digital literacy, although other studies also consider e-Skills in measuring digital readiness. However, most studies on digital learning acceptance, readiness and usage have underscored the importance of learners' access to digital devices (van Zyl et al. 2013; Soomro, et al., 2018). This was the case in this study where learners' readiness was measured in their access to digital technologies and access to internet. While the study did not show high access levels of digital technologies such as tablets/ipads and laptops, the findings revealed that majority of the students had access to smart phones. Learners' access to digital technologies sets the tone and creates the foundation for the effective implementation of technology-enabled learning environment. This also provides learners with the opportunity to learn at their own pace and time convenient to them (Awadhiya et al. 2014). It was also found that, most of the digital devices students had, also had internet capabilities, a strong indication that students are ready to make good use of the digital learning materials. This conclusion is premised on a study conducted by Miglani and Awadhiya (2017) to determine m-learning readiness and perception of teachers in Commonwealth Asian countries which concluded that teachers had readiness for m-learning on the basis of the availability of mobile devices and Internet connectivity. Thus, the current findings are similar to the study conducted by Miglani and Awadhiya (2017); While this study found that 89.9% of the respondents had access to technological devices with internet capabilities, the study of Miglani and Awadhiya (2017) which demonstrated readiness of the respondents to use digitized learning materials reported that 71% of respondents were able to conduct internet searches, 67% were able to check and send emails, 54% were able to download apps, 52% were able to engage in social networking and 53% had the ability to share images/audios/videos. Similarly, findings of this study seem to resonate with that of Msila (2015) which showed readiness to use digital technologies among respondents in a study conducted in South Africa; a similar context as that of Ghana. They found that 46.5% of the students had access to computers at home while 73.6% had access to a computer at school or work. In addition, only 9.3% of students had access to the Internet at home, while 29.9% had Internet access at school or work. Thus, it suffices to say that the level of access to digital technological devices reported in this study is significant and will serve a great opportunity to hasten the process of digitizing learning materials in the CoDE distance learning programme. This kind of access has been explained by van Dijk (2005) as material or physical access to ICT. He explained material or physical access to ICT as the custody or authorization to use digital technologies and warned that this kind of access should not be downplayed because it is very important and forms an essential condition to develop digital skills and ultimately utilize ICT to serve various purposes.

Exploring the challenges students anticipate to be associated with the new and emerging way of using digitized materials at CoDE, the findings were somehow not far-fetched. The study reported high cost of internet, weak device batteries, lack of internet access, external distractions and high-resolution screen lights as some of the challenges. These challenges seem to be associated with many developing countries. The findings are consistent with Nyandara (2012) who identified high cost of internet and lack of funds as impediments to eLearning adoption. Nyandara intimated that developing countries face the challenge of high cost of internet in terms of connection cost and other taxes that are transferred to the end-user who tries to access the internet.

These findings are not far from the findings reported in studies such as Nihuka (2011), Ngimi (2013) and, Nihuka and Voogt (2009).

Students' expectations are also critical to the acceptance of any new system. This study explored students' expectations of CoDE to assist in the use of the digitized content. Comments provided by the students demonstrate students' willingness to use the digital learning materials if the institution provides the needed digital resources to aid their use. Majority of the students called on the institution (CoDE) to provide them with technological resources such as tablets, laptop and desktop computers. Internet connectivity was another concern raised by the students. Access to the internet is critical in the modern approach of information transfer and sharing. In the context, Internet can be accessed through various means such as mobile cellular technology, satellite, wireless, dial-up service, and the digital subscriber line. The most widely used means has been the mobile cellular technology which provides internet bundles to users for a fee. This is likely to be easier for students to access information within the time frame of needs. Özdamar Keskin et al. (2015) made it clear that, 24/7 access to information in the fastest way possible remains the single most invaluable contribution of ICT to the twenty-first century. In looking at the benefits of digital resources, the use of digital technologies in the digital era has become a critical need of every society.

The students also called on the institution to provide them with internet bundles. According to them, the cost involved in providing such services could be settled in instalments and at affordable prices. They believed that provision of internet bundles is one of the obvious approaches to ensure a sustainable access to the internet through mobile learning technologies in the context. Mobile internet connection devices rely on internet bundles to maintain connection with internet service providers (ISPs). However, these connections are characterized by high cost of internet bundles and limited connectivity in our part of the world as have been reported by the respondents. This finding aligns with reports in literature which indicates that high cost of internet connection has been one of the main challenges militating against the readiness to use of digital resources (Andersson, 2008; Unwin et al., 2010; Kisanga & Ireson, 2015; Touray et al. 2013; Mwakyusa & Mwalyagile, 2016).

In spite of the number of challenges reported in the study, the students called on the institution to hasten the process of implementing the digitized programme. Some held the view that, the implementation is long overdue and should be done as quickly as possible. The comments by the students seem to suggest and further guarantee their readiness to use the digitized learning materials in this twenty-first century where technology is central to most activities in distance education programmes. In that regard, Awadhiya, et al. (2014) conclude that it is ICT that bridges the gap of isolation that is created by limited or no interaction among students and with the tutor, and plays a positive role in promoting interaction. Therefore, any initiative or intervention geared towards democratizing teaching and learning in distance education must be encouraged.

6 Conclusions and recommendations

Based on the findings that emerged from the study, we conclude that students of the CoDE are ready to use digitized learning materials and therefore there is the need for the institution to take the necessary measures to digitize learning material so as to ease

access and make learning materials available everywhere and anytime. Students' responses on what they expect from CoDE further provided a clear proof of readiness to use the digitized learning materials if some measures were taken to ensure successful implementation. The study therefore contends that the University should expedite process to implement the digitization of learning resources to the benefit of distance learning students and the institution. In the interim, the institution should take advantage of the high smart phones access levels of students and employ them to use such personal devices to access digitized materials when the programme is deployed. Subsequently, there will be a need for CoDE to liaise with telecommunication companies to supply digital resources at affordable prices to students. Better still, the government through the Ministry of Education (MoE) and other stakeholders in Education could collaborate with Internet Services Providers (ISPs) to provide internet access to distance learning students at a lower cost in order to encourage distance and lifelong learning in the College and similar institutions providing distant education.

References

- AECT (2001). *The handbook of research for educational communications and technology*. Retrieved from <http://members.aect.org/edtech/ed1/41/41-01.html>
- Agyei, D. D., & Voogt, J. (2015). Pre-service teachers' TPACK competencies for spreadsheet integration: Insights from a mathematics-specific instructional technology course. *Technology Pedagogy and Education, 24*(5), 605–625.
- Andersson, A. (2008). Seven major challenges for e-learning in developing countries: Case study eBIT, Sri Lanka. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 4*(3), 45–62.
- Awadhiya, A. K., Miglani, A., & Gowthaman, K. (2014). ICT usage by distance learners in India. *Turkish Online Journal of Distance Education, 15*(3), 242–253.
- Cheon, J., Lee, S., Crooks, S., & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers & Education, 59*(3), 1054–1064. <https://doi.org/10.1016/j.compedu.2012.04.015>.
- Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Over-coming challenges and developing strategies for effective learning. *The Psychologist, 26* (2), 120–123. ISSN 0952–8229 Available from: <http://eprints.uwe.ac.uk/21155>
- Dawn, L. (2017). Online, blended and technology-enhanced learning: Tools to facilitate community college student success in the digitally-driven workplace. *Contemporary Issues in Education Research – Fourth Quarter 2017., 10*(4), 255–262.
- Esterhuysen, M., & Scholtz, B. (2015). Barriers to e - Learning in a Developing Country: An Explorative Study. Proceedings of the 9th IDIA Conference, IDIA2015 , 354–367.
- Fabunmi, A. B., Paris, M., & Fabunmi, M. (2006). Digitization of library resource: Challenges and implications for policy and planning. *International Journal of African & African American Studies, 5*(2), 23–36.
- Heitin, L. (2017). What is digital literacy? *Education Week, 36*(12), 5–6. Retrieved from <http://www.edweek.org/ew/articles/2016/11/09/what-is-digital-literacy.html>
- Holzinger, A., Nischelwitzer, A. & Meisenberger, M. (2005). Mobile Phones as a Challenge for m-Learning: Examples of Mobile Interactive Learning Objects (MILOs). Third Annual IEEE International Conference on Pervasive Computing and Communications Kauai Island (HI), IEEE, (pp. 309).
- Horrigan, J. B. (2016). Digital Readiness Gaps. Pew Research Centre. Retrieved from: <https://www.pewinternet.org/2016/09/20/digital-readiness-gaps/>
- International Telecommunications Union. (2017). *Measuring the information society report 2017 volume 2*. Geneva: ICT country profiles. Place des Nation.
- Joo, Y., Bong, M., & Choi, H.-J. (2000). Self-Efficacy for Self-Regulated Learning, Academic Self-Efficacy, and Internet Self-Efficacy in Web-Based Instruction, *48*(2), 5–17.

- Kisanga, D., & Ireson, G. (2015). Barriers and strategies on adoption of e-learning in Tanzanian higher learning institutions: Lessons for adopters. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2015, 11(2), 126–137.
- Kwapong, O. (2009). Comparing knowledge and usage of ICT among male and female distance learners of an endowed and deprived area in a developing country in Africa. *Journal of Information Technology Education*, 8, 1–17.
- Lovasz, E. A., Lovasz, E., & Gruescu, M. C. (2014). Digital library of mechanisms. *Procedia – Social and Behavioral Sciences*, 163, 85–91.
- Miglani, A., & Awadhiya, A. K. (2017). Mobile learning: Readiness and perceptions of teachers of open universities of commonwealth Asia. *Journal of Learning and Development – JLAD*, 4(1), 58–71.
- Msila, V. (2015). Teacher readiness and information and communications technology (ICT) use in classrooms: A south African case study. *Creative Education*, 6, 1973–1981. <https://doi.org/10.4236/ce.2015.618202>.
- Mwakyusa, W. P., & Mwalyagile, N. V. (2016). Impediments of E-learning adoption in higher learning institutions of Tanzania: An empirical review. *Journal of Education and Practice*, 7(30), 152–160.
- Nihuka, K. A. (2011). Collaborative Course Design to Support Implementation of E-Learning by Instructors. PhD Thesis University of Twente, Enschede. ISBN 978–90–365–3235–8 DOI <https://doi.org/10.3990/1.9789036532358>
- Ngimi, H. M., (2013). Opportunities and Challenges of Integrating ICTs in Education Delivery in the Institute of Continuing Education at the Open University of Tanzania. M. ED (APPS) of Open University of Tanzania.
- Nihuka, K. A., & Voogt, J. (2009). E-Learning Course Design in Teacher Design Team: Experiences in the Open University of Tanzania Paper presented during the 13th Biannual Conference for Research on Learning and Instruction in Amsterdam, August 25th - 29th, 2009.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.
- Nyandara, Z. I. (2012). Challenges and Opportunities of Technology Based Instruction in Open and Distance Learning: A Comparative Study of Tanzania and China. Proceedings and report of the 5th UbuntuNet. Alliance annual conference, pp. 130–145.
- Özdamar Keskin, N., Özata, F. Z., Banar, K., & Royle, K. (2015). Examining digital literacy competences and learning habits of open and distance learners. *Contemporary Educational Technology*, 6(1), 74–90.
- Peter, S., & Deimann, M. (2013). On the role of openness in education: A historical reconstruction. *Open Praxis*, 5(1), 7–14. Retrieved from: <https://openpraxis.org/index.php/OpenPraxis/article/view/23/8>
- Republic of Ghana (2003). The ICT for Accelerated Development (ICT4AD) Policy. Ghana: Press.
- Republic of Ghana (2008). ICT in education policy. Ministry of Education: Author.
- Research Advisors Group (2006). Sample Size Table. Retrieved from: <https://www.research-advisors.com/tools/SampleSize.htm>
- Ribble, M. (2017). Digital Citizenship: Using Technology Appropriately. Digital Citizenship Institute. Retrieved from: <http://www.digitalcitizenship.net/nine-elements.html>
- Soomro, K. A., Kale, U., Curtis, R., Akcaoglu, M., & Bernstein, M. (2018). Development of an instrument to measure Faculty's information and communication technology access (FICTA). *Education and Information Technologies*, 23(1), 253–269. <https://doi.org/10.1007/s10639-017-9599-9>.
- Talebian, S., Mohammadi, H. M., & Rezvafar, A. (2014). Information and communication technology (ICT) in higher education: Advantages, disadvantages, conveniences and limitations of applying E-learning to agricultural students in Iran. *Procedia - Social and Behavioral Sciences*, 152, 300–305. <https://doi.org/10.1016/j.sbspro.2014.09.199>.
- Touray, A., Salminen, A., & Mursu, A. (2013). ICT barriers and critical success factors in developing countries. *The Electronic Journal of Information Systems in Developing Countries*, 56(7), 1–17.
- United Nations Educational Scientific and Cultural Organization. (2002). Open and distance learning: Trends, policy and strategy considerations. Retrieved from <http://unesdoc.unesco.org/images/0001284/1128463e.pdf>
- Unwin, T., Kleessen, B., Hollow, D., Williams, J. B., Oloo, L. M., Alwala, J., Mutimucuo, I., Eduardo, F., & Muianga, X. (2010). Digital learning management systems in Africa: Myths and realities. *Open Learning: The Journal of Open, Distance and e-Learning*, 25(1), 05–23.
- van Dijk, J. A. J. G. M. (2005). *The deepening divide: Inequality in the information society*. Thousand Oaks: Sage Publications.
- van Zyl, M. J., Els, C. J., & Blignaut, A. S. (2013). Development of ODL in a newly industrialized country according to face - to - face contact, ICT, and E- readiness. *The International Review of Research in Open and Distance Learning*, 14(1), 1–22.
- Vaske, J. J. (2008). *Survey research and analysis: Applications in parks, recreation and human dimensions*. State College, PA: Venture.

- Witten, I., & David, B. (2003). *How to build a digital library*. London: Morgan Kaufman Publishers.
- Wu, Y.-T., & Tsia, C.-C. (2006). University students' internet attitudes and internet self-efficacy: A study at three universities in Taiwan. *Cyberpsychology & Behavior*, 9(4), 441–452.

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