IAE Journal of Research and Development
(IJORED)
Vol. 2, Issue 1, March 2026, pp. 128-160,
eISSN: 3088-5515, pISSN: 3088-5523,
Published by IAE under **CC BY-NC** license
DOI: https://doi.org/10.61408/ijored2026v02i01.06

The Role of Mobile Technology in Enhancing Learning amongst Open and Distance Education Learners: A Case of Institute of Adult Education in Tanzania

Grace Mwangasa
Institute of Adult Education
Email: gracemwangasa0@gmail.com
ORCID: https://orcid.org/0009-0007-9655-3708

Received: 30 December 2025
Revised: 20 April 2026
Accepted: 27 April 2026
Published: 15 May 2026

Abstract

This study examines the role of mobile technology in enhancing learning among Open and Distance Learning (ODL) students at the Institute of Adult Education (IAE) in Tanzania. With the rapid growth of mobile device ownership and internet connectivity, mobile learning (m-learning) has become an important tool for expanding access to education, particularly for learners who cannot attend traditional face-to-face classes. The study adopted a holistic case study design involving lecturers, ODL students, and system administrators. Data were collected through questionnaires, semi-structured interviews, and observation to explore the accessibility, usage, benefits, and challenges of mobile learning technology within the institution. Findings reveal that mobile device ownership among both lecturers and students is very high, with smartphones being the most commonly used devices. Mobile technologies are widely used for academic communication, accessing learning materials, reading scholarly articles, sharing information resources, and checking examination results. Platforms such as Moodle, Zoom, and web browsers have facilitated remote learning, enabling students to study anytime and anywhere. This flexibility is

particularly beneficial for ODL students who balance education with work and family responsibilities. However, the study also identified several challenges affecting the effective use of mobile learning technology. These include limited digital literacy amongst some students, unstable internet connectivity in rural study centres, limited storage capacity and small screen sizes of mobile devices, and resistance to technological adoption among some lecturers. Despite these challenges, the study concludes that mobile learning has significant potential to improve accessibility, collaboration, and quality of education in ODL programmes. Strengthening infrastructure, improving digital skills, and institutionalizing mobile learning policies are essential steps toward maximizing the benefits of mobile technology in higher education.

Key words: *Mobile technology, open and distance learning education, learners.*

How to cite: Mwangasa, G. (2026). The Role of Mobile Technology in Enhancing Learning amongst Open and Distance Education Learners: A Case of Institute of Adult Education in Tanzania. *IAE Journal of Research and Development, 2*(1), 128-160. DOI: https://doi.org/10.61408/ijored2026v02i01.06

Introduction

Rapid technological advancement and high mobile penetration rates in developing countries, has broadened the horizon of education. According to International Telecommunication Union (2021), the Global mobile-cellular subscription rate in 2021 was 110% per 100 people. In Malaysia, most students used smartphones (79.2%) for their learning. Then, it is followed by mobile phones (16.9%), others (1.5%), Personal Digital Assistance (1.5%) and tablets (0.8%) (Karim, R. A. 2020). In America Mobile devices including phones and tablets are the most prevalent technology on earth; 92% of United States adults own cell phones, 68% own a smartphone, and 45% own a tablet computer, with each ownership category rising over the last five years. In Ghana, the mobile voice, and data rates in 2020 were 131% and 86% respectively with forty million subscribers (National Communications Authority (2021). According to TCRA, (2024), the total mobile subscription and penetration rate in 2024 in Tanzania

reached 76.6 million up in June 2024 from 73.4 million in March 2024 representing a quarterly increase of 4.3% with a significant increase in subscription of around 3.2 million. Total internet subscription reached 39.3 million in June 2024. Mobile wireless accounted for 99.5% of all internet subscriptions. Every individual has got the right to education. Mobile technology can provide any individual with educational experiences through mobile devices everywhere and anytime. Mobile devices allow educational socialization at a distance and promote collaboration between students, and the use of mobile devices allows users to move and access content and information from anywhere and at any time. Distance education through online education encourages social mobility in learning.

Mobile learning is an emerging technology embraced by higher learning institutions involving the use of mobile devices when a learner is not at a fixed location. It is a form of learning across multiple contexts through social and content interactions using personal electronic devices. M-learning could be seen as the next generation of electronic learning (e-learning) that uses mobile technology (Golenhofen et al., 2020; Leung & Cheng, 2019). It is therefore a new learning approach that occurs using mobile devices (Qureshi et al, 2020). Adzifome and Agyei, (2023), assert that, the ubiquity and widespread usage of mobile devices on college campuses beckons the integration of mobile learning in the delivery of higher education and the promotion of student-centred and lifelong learning. Currently, mobile devices have become crucial in teaching and learning in higher learning institutions due to their unceasing benefits. Despite the numerous potentials of mobile learning, it has received minimal attention and encouragement for its usage for teaching and learning, particularly in Africa (Arthur-Nyarko et al., 2020).

Education is an axiomatic right for all individuals. Nevertheless, inequality in education opportunities still prevents millions of people from receiving the education they deserve. There are significant obstacles that hinder the huge number of learners undergoing further

studies. Hence, they lack opportunity to leave their families, positions, marriages, and join studies. Apart from this, Uchidiuno et al. (2018) contend that Learners may experience educational disparities, which include the shortage of skilled instructors, school infrastructure, and overall educational support, which reduce the opportunities available to them.

In other hand, the global changes in teaching and learning as a response to the Covid-19 pandemic, student interaction in the learning process has been challenged. As a response to the Covid-19 pandemic, education institutions globally have seen a rise in remote, distance, and blended learning approaches (Aristovnik et al., 2020 Motala & Menon, 2020, Osman, 2020 Thistlethwaite et al., 2020). While mobile devices are making some types of learning easier to access, they have the potential to deliver the kind of learning that in past times could only have been done with a knowledgeable tutor working on-site, alongside the student (Peters, 2007).

In Tanzania, Distance Education (ED) can be traced back to the 1960s when indigenous correspondence courses were first prepared by the National Co-operative College established in 1963. The Institute of Adult Education (IAE) is an autonomous institution established by parliamentary Act No. 12 of 1975. The institute is authorised by the National Council for Technical, Vocational Education, and Training (NACTVET) to offer both tertiary and basic education programmes. However, the Open and Distance Learning (ODL) in higher education started in 1992 under the Act of Parliament No. 17.

The Institute of Adult Education conducts its operation through regional centres. Currently, it has four campuses including Dar es Salaam, Morogoro, Mwanza and Ruvuma. There are 26 regional centres and 78 study centres spread out national wide. At every regional centre there are study centres to provide services to ODL students. There are two kinds of students at the IAE. The first type is those who study under full time (conventional) and the second kind

studies through open and distant learning (ODL). 90% of the students at IAE study through ODL and the rest (10%) take the full time (conventional) mode of study. According to the huge number of ODL students at IAE and with the intention of overcoming the challenges ahead on ensuring learning resources are available and accessible to students, decided to shift from using the plain text format in which a student had to wait for hard copies of modules, adopted e-learning approaches to teaching and learning. The adoption of e-learning approaches in teaching and learning has spurred the formalization of mobile technology use in IAE regardless of the challenges it poses to both lecturers and students. Mobile learning was not intended, and it is still not captured in any of institution's policy document, the institution has initiated measures to explore the potential of ICT use to improve the quality of instruction in running its programmes using the hybrid mode of face to face and online using a mobile Modular Oriented Digital Learning (MOODLE) platforms. Since its institutionalization at IAE in 2021 soon after the outbreak of COVID -19 there was a delay in the adoption of the technology due to reluctance of the users especially lecturers who were not ready to apply the technology in teaching and learning until when it was forced by the administrators. Therefore, early in 2025 the institution held ZOOM sessions for ODL students and MOODLE platforms started for bachelor students only. In this regard the study examines the current practice of mobile learning technology at IAE from both students and lecturers' perspectives.

Different people define mobile learning (M- learning) differently. Its dynamic capabilities which is exhibited through the ways it can enhance collaborative learning, ubiquitous learning, storage capability, online learning and other inherent benefits has made it enticing for stakeholders in the education sector. Mobile learning is any form of educational delivery in which the primary technologies are handheld devices and wireless transmission (Kankam, 2020). Osakwe, et al. (2019), define mobile learning as using mobile devices to make

learning happen ubiquitously. This means that learning is facilitated through devices like iPad, smartphones podcast, personal digital assistants (PDA), etc. M-learning could be seen as the next generation of electronic learning (e-learning) that uses mobile technology (Fatima et al., 2019; Golenhofen et al., 2020; Leung & Cheng, 2019). It is therefore a new learning approach that occurs using mobile devices (Qureshi et al., 2020). Mobile Learning has come to people's attention because mobile devices are potable, ubiquitous, and easily accessible and used by many people. Since smart phones and mobile Apps are getting popular, it strongly indicates that move from web-based systems to mobile friendly systems may bring evolution in students 'learning. Connectivity is a primary purpose of a mobile device, and affords learners the ability to communicate with peers, educators, experts, and the world, as well as interact with content (i.e., consuming, editing, and producing) devoid of spatial and temporal constrictions. E-learning occurs on the internet and mobile learning presents learning opportunities that are provided through mobile networks with internet connectivity (Okai-Ugbaje et al., 2020). The connectivity feature enables M-learning to offer interactive experiences that could be structured with sharing, exploration, and application (Golenhofen et al., 2020). This means that learning is facilitated through devices like iPad, smartphones, podcast, personal digital assistants (PDA) etc.

According to research studies, mobile learning has peculiar features. Mobile devices are characterised by *immediacy* (Gambo & Shakir, 2019; Onah et al., 2021); thus, it is synchronous and allows for instant sending or receiving of information in real-time. Mobile learning models besides technologies allow access to learning materials irrespective of one's location and time, provided there is internet access. *Privacy*- Mobile learning is characterized by a high level of privacy. Only one learner has access to the device at a time and its usage by the learner for downloading information, access to information and getting feedback is independent of other learners

(Willemse et al., 2019). *Pedagogical Change*- this is another feature of mobile devices; they have ability to provide varying levels of pedagogy. According to Mehdipour & Zerehkafi (2013), this characteristic allows for varying learning methods [media] which include voice instruction, graphical elements, video and animations that promote authentic experiences for students' learning. *Accessibility* refers to the extent to which every learner owns the mobile. These days almost most of the learners have the technology regardless of the place they are living. The key feature of mobile learning is its ability to provide learning that is 'just in time, just enough and just for me;' learning that is situated (typically in the field or at the workplace); and learning that is contextualized through mediation with peers and teachers. It is also possible to the learners to communicate with each other around or with their colleagues and professionals in distant areas through the mobile, which has different applications.

How individuals learn and how learning takes place require serious attention. Diverse types of mobile learning have developed, including self-directed, behavioural, cognitive, informal, collaborative, and situated learning. Flexible features of mobile technologies, which allow students to learn at their own pace and on their own schedule, facilitate self-directed learning. The use of mobile devices to present learning materials obtains responses from learners and provides appropriate feedback fit within behaviourist learning theory. It applies drill and practice strategies to achieve learning that results in changing the learner's behaviour by focusing on the output of the learning process and reinforcing the concepts of interaction and practice. Serhat, 2022 argues that Behavioural learning arises when students use mobile devices to provide a solution (response) to a problem (stimulus) when they collaborate with their tutors. When mobile technology's multimedia features offer animations, images, video, audio, MMS, SMS, podcasting, and e-mails to aid in the acquisition, processing, and delivery of information for learning Facilitate cognitive learning. Collaborative learning occurs when ODL learners use mobile technologies to effectively create and share information and Situated learning transpires when authentic digital

Learning Management Systems, and other ubiquitous computing environments provide appropriate context and opportunities for students to interact with their tutors in a convenient manner using mobile learning tools to access the right information wherever and whenever they need it (Wong et al., 2015). When students acquire knowledge independently from informal sources and incorporate it into formal education knowledge using mobile learning technologies this will be informal learning.

Thus, people learn to perform a new task or even carry out a routine task in a more efficient or elegant manner. Technology that is used to support learning should be blended with everyday life in the same way that learning is blended with everyday life seamlessly and unobtrusively.

The major use of these devices is for communication (such as video call, short Message Service (SMS), email), web browsing, gaming and social media. Additionally, it also provides platforms as a learning tool: quiz, gamification and game-based learning, digital assessment tools and podcasts. This situation shows that there is a great potential to enhance learning with mobile devices (Aziz, et al 2021). The current web-based tools like Moodle, Blackboard, Academic Management System, ZOOM and many others not only make the students' learning more interactive but also more apprehensive and comprehensive (Peng H. et al. 2019).

In Namibia (Osakwe, et al. 2019), found that, there is also a high response rate in downloading educational materials, downloading educational applications via mobile devices, using mobile devices as calculators and finding unknown words through mobile devices. In Nigeria, the author found that m-Learning is perceived to be useful by students hence, they are motivated to participate in learning activities. It could be inferred that there is a correlation between user motivation and engagement with m Learning. Such claims inspire hope for the use of m- Learning to realise SDG 4 – Quality education and its benefits in SSA (Ogundaini, & Mlitwa, 2023).

Mobile learning holds a lot of potential for quality teaching and learning, content improvement, and increasing access, especially in Africa (UNESCO, 2012; Oyelere et al., 2018; Willemse et al., 2019). Criollo-C et al., 2021; El-Sofany & ElHaggar, (2020) contend that Mobile learning is an effective way of increasing access, diversifying and improving instruction, enhancing learning and improving educational outcomes. The integration of digital technologies, especially mobile learning in the classroom supports individualized learning in large classes, collaboration, and makes learning interesting (Troussas et al., 2020). Mobile learning has exhibited many advantages over the traditional approaches of instruction, as it is less costly, provides increased accessibility from anywhere and anytime, promotes self-efficacy and self- regulation in learning (Gambo &Shakir 2019; Onah et al., 2021). Gambo & Shakir (2019) argue that mobile learning provides a student-centred environment that facilitates retention. It offers students an environment that allows for a better understanding of educational content and thus has the potential to facilitate their adaptation to solving novel problems in different contexts.

Methodology

The study adopted a holistic case study research design. This design was used because it generates an understanding of how the current situation or characteristics developed for practical reasons. It constitutes an intensive study of factors that contribute to the characteristics of the case. The case study provides a unique example of real people in real situations for readers to understand ideas more clearly (Cohen, Manion &Morrison, 2007). This design was appropriate in this study because it enabled the researcher to collect exhaustive, comprehensive and incorporated information. It provides in-depth description of a phenomenon from individuals, groups and institutions concerning the current practice of mobile technology to ODL. In this study the phenomenon is the mobile learning

technology used by ODL students to enhance quality education. The study consisted of three categories of respondents: lecturers, ODL students, system administrators. These population categories were intended to provide relevant data on ODL and mobile learning technology. Lecturers were involved because they are implementers of mobile learning technology. Students ODL students are the target population since are the daily users of technology, so they have first-hand information on the new technology and its application, and they have experience with the effectiveness of the application of such technology and the challenge they face. On the other hand, technicians were involved in the study because they engaged in the installation of the mobile technology infrastructure. So, they provided information on 'know-how' skills, which is search, installation and customization of the mobile software application. The sample size of this study was made up of seventy respondents who provided the relevant information to the study. Lecturers were selected through simple random sampling. Stratified sampling technique was used to select students. On the other hand, system administrators and technicians were selected purposively to form a sample.

The study employed semi-structured interviews as the flexible formal based guide whereby the formal remains the choice of the interviewer who can conduct the interview to get the insight and attitude of the interviewee. The semi-structured interview was administered face to face to the lecturers, as they are the first clients in using mobile technology in teaching and learning. These interviews were used to determine how lecturers deliver and students access learning materials using mobile technology as well as the benefit of using mobile learning in the teaching and learning process. The researcher also employed closed and open-ended questions to collect information from the students. The use of questionnaires enabled the researcher to collect adequate information. This enhanced the depth in data collection and made the interviewer considerable flexibility over the order of questions within a loosely connected framework, to identify

students' perceptions on the use of mobile technology in learning. Observation ascertained information obtained from the use for interviews and questionnaire. This helped to obtain a valid and credible picture of the study. Therefore, observation was used to determine the level of using mobile technology in learning specifically in the process of uploading and downloading learning materials.

Use of Artificial Intelligence Tools

I hereby declare that Artificial Intelligence (AI) tools were used only to support the editing process of this research paper, including language refinement, grammar correction, sentence restructuring, and enhancement of clarity and readability.

Results and discussion

Accessibility of Mobile Technology

A list of different mobile devices was listed for them to identify the devices that are useful for learning as shown in Table 1.

Table 1: Access of Mobile Technology

Category	Frequency	Percent
Laptops	35	87.5
Internet/intranet	38	95
Video conferencing	3	7.5
Television/radio	39	97.5
Mobile phones	40	100
Audiotapes	11	27.5
Videotapes	5	12.5
DVDs/CDs	25	62.5

Source: Field Data (2026)

The results reveal that all ODL students' respondents have access to mobile devices specifically they own Smart phones and iPads. Not only that but also the majority have access to internet/intranet, television/radio, desktops as well as laptops. This was supported by interview findings from the IAE official from IAE headquarters who had this to say;

> We have different types of mobile technology that both lecturers and students use in teaching and learning, the most used are computers (desktops and laptops) we have the computer labs where lectures and students are free to use, other forms are mobile phones, television/radio, internet, DVDs and CDs. All these assist lecturers and students in accessing teaching and learning materials (interview, ICT official from IAE headquarter February 20th, 2026)

The result indicates that both lecturers and students own multiple forms of technologies in teaching and learning. 100% of the students noted that they own mobile phones, especially smartphones and tablets pc capable of accessing internet. On the side of lecturers, the percentage of ownership is high whereby all interviewed lecturers' own smartphones and laptops. This means that ownership of mobile devices is spread among majority of lecturers and students.

This result aligns with global trends indicating increased smartphone penetration in developing countries, where mobile devices serve as primary gateways to digital learning (International Telecommunication Union [ITU], 2023). Similarly, Crompton and Burke (2018) argue that the rapid expansion of smartphone ownership has significantly influenced the growth of mobile learning in higher education. The high level of device ownership among both students and lecturers at IAE suggests that the institution possesses a strong technological foundation for implementing mobile learning strategies.

However, access to advanced services such as video conferencing was relatively low (7.5%), suggesting that ownership does not automatically translate into full technological capability. This supports the argument by Traxler (2018) that digital access must be understood not only in terms of device availability but also in terms of functional capacity and connectivity quality.

Usage of mobile devices in academic purposes

A questionnaire with students was used to obtain relevant information, to determine the mobile technology services that were accessed by their mobile devices. Table presents the results of the findings;

Table 2: Mobile technology services accessed by ODL students

No	Services category	Very useful	Useful	Not much useful	Not applicable
1	Reading scholarly articles	25(62.5%)	11(28%)	3(7.55%)	1(3%)
2	Collecting data	24(60%)	12(30%)	4(10%)	0
3	Messaging	23(58%)	11(28%)	5(13%)	1(3%)
4	Reading text books	15(37.5%)	12(30%)	10(25%)	3(7.5%)
5	Using online dictionaries	23(57%)	9(22.5%)	7(17%)	1(3%)
6	Searching library catalogues	2(5%)	3(7.5%)	4(10%)	31(77.5%)
7	Sharing information resources	32(80%)	7(17%)	1(3%)	0
8	Charting with friends	17(43%)	15(38%)	7(18%)	1(3%)
9	Listening music	6(15%)	9(23%)	19(48%)	6(14%)
10	Receiving calls and dialling calls	24(60%)	16(40%)	0	0

Source: Field Data (2026)

The findings presented in Table 2 revealed that most of the ODL students at IAE were accessing mobile technology services. 76% of students from Mlowo Centre said yes. The other 24% of ODL students said that they do not use it. Students from Korogwe Centre 87% agreed that they use the mobile devices for academic purposes; the other 13% said they don't. 90% of students from Dar es Salaam Centre agreed that they utilize mobile devices for academic purposes and 10% said they don't. It was revealed that those who didn't use mobile devices for academic use lacked technological skills and other devices had low capability. According to the findings in table 2 reveals

the following observation; most of the students are using their mobile phones for academic activities. This implies that mobile learning technology has facilitated the teaching and learning activities for ODL students at IAE. To justify the information generated through questionnaire, during interviews one student from Dar es Salaam Campus was asked to explain the usefulness of mobile technology in facilitating the daily academic activities. In response the students said:

> For me this smartphone is everything in my studies, because I use it to set appointments with my fellow students to make an arrangement for discussion, and I can access the uploaded materials for studies, and any information sent through emails, normal SMS of different information concerning academic issues. I even use it to notify my colleague whatever sent including assignments, course results a few to mention (Student 3).

Another student from IAE Mlowo Centre explained the situation as follows during interview:

> The use of technology in learning has helped us a lot, since I can learn without moving from one place to another looking for materials because everything is now computerized and I can access the materials that I want through the Institute web, using my mobile phone. Previously I used to order books and modules from Dar es Salaam for my studies but today I can access through my mobile phone to access the digital library. (Interview with student 6, January 2026)

Lecturers were asked whether they use mobile devices for academic purposes. 100% of lecturer respondents agreed that they utilize mobile devices for academic purposes. It therefore shows that all the lecturers are already using mobile devices to carry out academic activities.

These findings are consistent with Al-Emran et al. (2020), who found that communication and collaboration are among the primary drivers of mobile learning adoption in higher education. Similarly, Sung et al. (2016) established that mobile devices enhance student engagement by facilitating flexible access to learning materials and peer interaction. The qualitative findings further showed that students relied heavily on smartphones to access digital libraries, download modules, and receive examination results. This reflects the flexibility principle central to ODL

systems (Moore & Diehl, 2019). Mobile learning reduces geographical barriers, allowing students in remote areas to participate in academic activities without physical presence at study centres. Nevertheless, limited use of mobile devices for searching library catalogues (77.5% not applicable) indicates underutilization of institutional academic databases. According to Park (2019), effective mobile learning requires structured institutional support to guide students toward productive academic usage rather than general browsing.

Time spent on academic activities

Students were asked to mention the total minutes they spent per week using their mobile phones for academic purposes the findings are presented in Table 3:

Table 3: Time spent on using mobile technology for academic activities

Time in minutes	Frequency	Percentage
40-60min	43	78.1
20-40min	6	10.9
10-20min	4	7.3
1-10min	2	3.6
Total	55	100

Source: Field data, (2026)

Data in table 3 reveals the following observation: most of the students are using their mobile phones for academic purposes. This implies that mobile learning technology has facilitated the teaching and learning activities for ODL students at IAE.

Research by Kukulska-Hulme (2020) suggests that students often use mobile devices in short, fragmented learning sessions rather than prolonged study periods. This micro-learning pattern may explain the moderate weekly usage time observed at IAE. It may also reflect infrastructural challenges such as unstable internet connectivity, which limit sustained engagement.

Areas in which mobile technology was mostly used

The study further investigated the areas in which mobile technology was mostly being used. This was to measure the mobile learning practices among the members of IAE. The respondents were asked to identify the areas in which mobile technology was mostly used. The research findings are presented in table 4.

Table 4: Areas in which mobile technology was mostly used

S/N	Usage Areas	Number of users	Percentage	Users did not use mobile tech	Percent
1.	Instructional/ teaching purpose through Zoom, Yahoo and Google meetings	43	78	12	22
2.	Examination results handling	47	85	8	14
3.	Communication for academic purpose	52	95	3	5
4.	Posting advertisement on the institute web/notes board	10	18	45	82
5.	For entertainment	45	82	10	18
6.	For accountancy and Finance transaction	20	36	35	63
7.	For administration purpose	33	60	22	40
8.	For my personal use	6	10	49	89
9.	Using online dictionaries	49	89	6	11

Source: Field Data (2026)

Data in table 4 shows that teaching purpose, handling examination results, lecturers and students communication and using dictionaries are some of the major areas for which mobile learning technology was used in ODL at IAE. This was supported by interview findings from ODL students as one of them explained:

> Look I have my mobile here I can show you how practically I use it to access any information from the institute website, I can open and access materials and read any information even when I am at home or even for from this region. Everything is possible even when results are uploaded, I can get them. (Interview, students from Dar es Salaam Centre, January 16th, 2026)

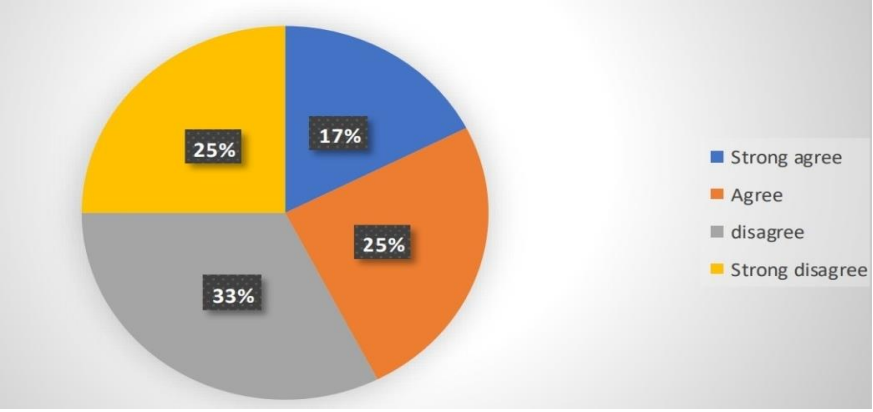
This shows that the integration of mobile technology in the ODL programme has simplified the teaching and learning process since learning could take place even when the students were located far from the IAE centre.

These findings confirm that mobile learning at IAE supports both pedagogical and administrative functions. According to UNESCO (2023), mobile technologies enhance not only content delivery but also academic management systems, thereby improving institutional efficiency. However, the high rate of entertainment use (82%) suggests competing uses of mobile devices. As noted by Al-Emran et al. (2020), while mobile devices enhance learning flexibility, they may also introduce distractions that affect academic performance if not properly regulated.

Students' knowledge in using mobile learning technology in academic activities

Research participants were asked to indicate whether they had adequate digital literacy skills and knowledge on how to use their mobile phones in their daily academic activities. The question was intended to know the level of knowledge (know how) on using the mobile technology. The findings indicate that most of the respondents had low digital literacy skills and knowledge on using mobile learning technology in their academic activities therefore, failed to use their mobile phones to facilitate learning. The findings suggest that only a few students 17% had skills and knowledge on using mobile technology in learning Figure 1.

Figure 1: Students knowledge on using mobile learning technology in academic activities



One system administrator who said supported:

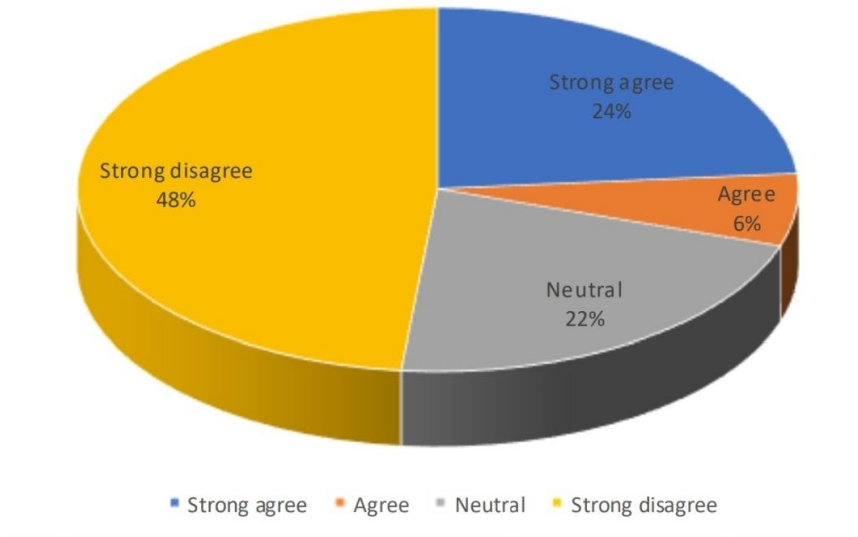
> I normally assist students in handling online issues such as online applications for new applicants, generating payment control numbers and registration of subjects. Even if we are still oriented, they can't manage to do it on their own since they lack digital literacy. The only thing that they manage is to download sent modules for studies. (Interview, system administrator March, 2026)

The findings align with van Deursen and van Dijk (2019), who argue that digital inequality increasingly manifests as differences in skills rather than access. Even when devices are available, insufficient digital competence limits effective utilization. Similarly, the ITU (2023) emphasises that digital literacy is essential for meaningful participation in digital education ecosystems. At IAE, students' inability to independently complete online registration and subject enrolment processes demonstrates that technical skills training is urgently needed.

Availability of infrastructure to facilitate mobile learning technology

The researcher also wanted to examine the availability of infrastructure such as internet connectivity in facilitating daily learning activities at IAE.

Figure 2: Availability of infrastructure to facilitate mobile learning technology



Data in the Figure 2 indicates that 22 percent of the student in the studies centres agreed on the availability of infrastructure that facilitates daily academic activities. Almost half (30%) agreed the presence of internet those are found in regional city centres, specifically in Dar es Salaam campus In other side 50% disagreed with the statement. These findings suggest that mobile learning infrastructure at IAE is mostly available in cities like Dar es Salaam and is less available in remote centres areas.

Similarly, a system administrator insisted that there was a problem with the internet network to facilitate students' daily academic activities. In this regard, the system administrator from Mlowo Centre said:

> We normally use personal internet that is always not stable. Sometimes it works effectively but the other time you need to tolerate since it can take sometime to be active again. So the mobile learning system can pose a problem to lecturers and students once they are in teaching and learning process. (Interview, System Administrator Mlowo Centre January, 2026)

The respondent added:

> The issue of network is a great problem to me especially when comes the issue of registering subjects. Even if I buy bundles still the internet is unreliable. So, when it comes the issue of zoom meeting we fail to join because of the unstable network. (Interview, student from Harungu, Mlowo January 2026)

The reality is that the availability of infrastructure such as internet connectivity ensures the usability of mobile learning technology in daily academic activities, especially in downloading and uploading materials particularly loose files.

This confirms Traxler's (2018) assertion that infrastructure remains a major barrier to mobile learning implementation in developing contexts. Reliable connectivity is crucial for activities such as downloading materials, participating in virtual meetings, and submitting assignments. UNESCO (2023) also highlights that rural–urban digital divides continue to hinder equitable access to digital education. The disparity between Dar es Salaam and remote centres reflects broader structural inequalities in digital infrastructure distribution.

Effectiveness of mobile phone browsers students' use to access learning materials

Students were asked to indicate their agreement with the effectiveness of the mobile browser they used in daily academic activities through their mobile phones. The findings are summarized and presented in Table 5.

Table 5: Effective mobile browsers used in academic activities (N= 40)

Browser software	Frequency	Percentage
Google Chrome	18	45%
Mozilla firefox	10	25%
Internet explore	2	5%
Opera	8	20%
Opera Mini	2	5%
Total	40	100

Source: Field data (2026)

Data in table 5 suggest that a considerable number of students are using Mozilla firefox, Google Chrome and Opera browsers for effective surfing of materials. The lecturer from IAE Dar es Salaam Campus also supported this during interview and said;

> When I want to search the meaning of the difficult word during teaching sessions I normally use Google chrome, Mozilla fire fox and Opera Mini for quick responses. Some of the browsers software are so slow that it takes a long time to bring the results but others are easily functioning. I prefer these because they have a good display and reproduction of web sites with a use- friendly interface. (A female lecturer from Dar es Salaam Campus February, 2026)

In other words, the lecturers were using their mobile phones that support internet service and mentioned to be using the web services through their mobile phones.

According to Park (2019), perceived ease of use significantly influences technology acceptance in mobile learning environments. When platforms are slow or incompatible, students are less likely to engage consistently. Therefore, optimizing institutional websites for commonly used browsers can enhance accessibility and user experience.

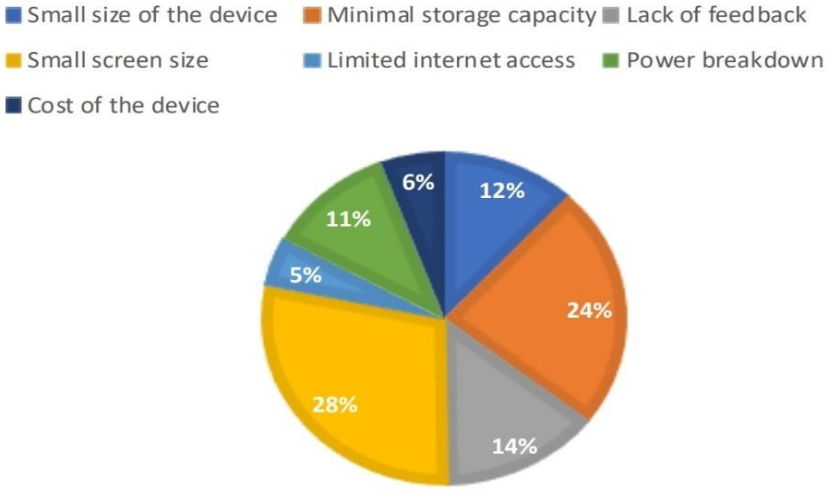
Challenges lecturers and students face in the usage of mobile learning technology

This section sought to identify the challenges, which lecturers and ODL students encountered during teaching and learning process through mobile technology. The challenges are divided into two subsections, usage- related challenges and awareness and attitude related challenges;

Mobile technology usage related challenges

Student respondents were asked to identify the challenges which hindered them from using mobile learning technology. The findings are summarized and presented in Figure 3.

Figure 3: Challenges students face in using mobile learning devices



Data in figure 3 show that small screen size, minimal storage capacity, lack of feedback and power breakdown were identified as critical challenges that hindered the effective application of their mobile devices. Moreover, the findings show that there were other challenges, which lectures encountered in the implementation of mobile learning. As one lecturer explained;

> Teaching using mobile devices has so many challenges, especially in its usage. As you know according to the nature of some mobile devices their capacity is so small that you cannot store many files on them. Also the nature of the content when you download they come in such small font that you need to put your eyes close to the devices to read so this is a challenge to users. (Interview with a lecturer from Mlowo centre January, 2026)

Indeed, some mobile devices have a small storage capacity that limits the storage of many files unless they have a slot for a micro SD drive. As a result, lecturers and students fail to use their mobile devices for storage purposes. Also the nature of the content having small font is a challenges for users to read the downloaded materials for a long time. Therefore, these hinder some lecturers and students to fully integrate the use of mobile phones in the teaching and learning.

Awareness and Attitude related Challenges

Research findings show that some lecturers had a negative attitude towards the usage of mobile learning technology. They did not appreciate that it was an effective way of teaching. In this regard, one lecturer established:

> I myself had never used mobile phones for teaching. This is a new technology, and I am trying to familiarize its implementation using ZOOM meeting classes. It is a new technology, and it needs time and someone who is skilled enough in using it. I think it requires training and time for practice. Moreover, we have no way of escaping it since the technology has already been integrated in a methodology. There is no way we can remain backward we need to run as fast as technology do. Though our technology level is still low. (Interview, lecturer Dar Campus March 2026)

Another lecturer put in this way;

> I have been teaching for many years and producing competent graduates but all these years I didn't use digital content and technological- based teaching. Why should I use a mobile phone? (Interview, aged lecturer from Dar es Salaam Campus March, 2026)

In fact, regardless of the effectiveness of mobile learning technology in teaching and learning, it is important for all stakeholders in an institution to know the existence of new technology and its

importance. However, when other lecturers lack enough knowledge and skills on how to use mobile devices this leads to ineffective implementation of the new technology. As a result, there are delay in attaining the intended objectives and producing graduates of less quality.

The study identified several technical challenges, including small screen size, limited storage capacity, small font display, power interruptions, and unstable internet. These findings are consistent with Kukulska-Hulme (2020), who notes that ergonomic limitations of mobile devices can hinder prolonged academic engagement. In addition, some lecturers expressed resistance to adopting mobile technology, citing lack of familiarity and preference for traditional methods. According to the Technology Acceptance Model (TAM), perceived usefulness and ease of use significantly influence technology adoption (Al-Emran et al., 2020). Negative attitudes and insufficient training reduce successful integration.

This suggests that institutional change must involve not only technological upgrades but also professional development programmes to improve staff confidence and competence in digital pedagogy.

Conclusion

The study concludes that mobile technology plays a crucial role in supporting teaching and learning among Open and Distance Learning (ODL) students at the Institute of Adult Education. The high level of smartphone and digital device ownership among both students and lecturers provides a strong foundation for the integration of mobile learning into educational practices. Mobile devices are widely used for accessing learning materials, facilitating communication between lecturers and students, supporting academic collaboration, and managing administrative activities such as examination results and academic notifications. These practices demonstrate that mobile learning enhances flexibility, accessibility, and student-centred learning, which are key principles of open and distance education.

However, the study also identified several challenges that limit the full effectiveness of mobile learning. These include inadequate digital literacy among some students, unstable internet connectivity, particularly in rural study centres, technical limitations of mobile devices such as small screen sizes and limited storage capacity, and resistance to technological adoption among some lecturers.

Recommendations

To maximise the benefits of mobile learning, several strategic measures are recommended. First, the institution should develop and implement a formal policy that integrates mobile learning into teaching and learning practices. Second, regular training programs should be provided to both students and lecturers to strengthen digital literacy and technological competence. Third, the institution should invest in improving ICT infrastructure, especially reliable internet connectivity across regional and remote study centres. In addition, lecturers should be encouraged to design mobile-friendly learning materials and use interactive digital platforms such as learning management systems and virtual communication tools. Finally, strengthening technical support services will help students and staff effectively address technological challenges and ensure the sustainability of mobile learning initiatives. Future research could investigate how lecturers' design and implementation of mobile-friendly learning materials, such as micro learning modules, gamified content, and adaptive assessments, affect students' motivation, engagement, and knowledge retention in mobile learning environments.

Conflict of Interest

The author is employed by the Institute of Adult Education, Tanzania, where the study was conducted. However, the institution had no role in the design, analysis, or interpretation of the data.

Funding Declaration

The author declares that no financial support or specific grants were received from any funding agency in the public, commercial, or not-for-profit sectors for the conduct of this research.

References

Adapa, A., Nah, F. F.-H., Hall, R. H., Siau, K., & Smith, S. N. (2018). Factors influencing the adoption of smart wearable devices. *International Journal of Human–Computer Interaction, 34*(5), 399–409. https://doi.org/10.1080/10447318.2017.1357902.

Adzifome, N. S., & Agyei, D. D. (2023). Learning with mobile devices—Insights from a university setting in Ghana. *Education and Information Technologies, 28*(3), 3381–3399. https://doi.org/10.1007/s10639-022-11294-5.

Afful, D., & Boateng, J. K. (2023). Mobile learning behaviour of university students in Ghana. *Cogent Social Sciences, 9*(1), Article 2204712. https://doi.org/10.1080/23311886.2023.2204712.

Alam, M., Al-Mamun, M., Pramanik, M. N. H., Jahan, I., Khan, M. R., Dishi, T. T., & Hossain, M. J. (2022). Paradigm shifting of education system during COVID-19 pandemic: A qualitative study on education components. *Heliyon, 8*(12), Article e12125. https://doi.org/10.1016/j.heliyon.2022.e12125.

Al-Emran, M., Mezhuyev, V., & Kamaludin, A. (2018). Technology Acceptance Model in mobile learning context: A systematic review. *Computers & Education, 125*, 389–412. https://doi.org/10.1016/j.compedu.2018.06.008.

Alghazi, S. S., Wong, S. Y., Kamsin, A., Yadegaridehkordi, E., & Shuib, L. (2020). Towards sustainable mobile learning: A brief review of the factors influencing acceptance of the use of mobile phones as learning tools. *Sustainability, 12*(24), Article 10527. https://doi.org/10.3390/su122410527.

Anderson, M. (2019, July 25). *Mobile technology and home broadband 2019*. Pew Research Center. https://www.pewresearch.org/internet/2019/07/25/mobile-technology-and-home-broadband-2019/.

Aziz, S., Kadel, R., Guruge, D. B., Paudel, K., & Karagiannidis, V. (2021). Mobile learning approaches and its impact on students' education—A survey. *International Journal of Information and Education Technology, 11*(9), 429–435. https://doi.org/10.18178/ijiet.2021.11.9.1546.

Bengöz, A., & Gencer, C. (2025). Savunma planlamada geleceğe yönelik senaryoların değer odaklı düşünme yöntemi ile analizi [Analysis of future-oriented scenarios in defense planning with value-oriented thinking method]. *Politeknik Dergisi, 28*(1), 59–66. https://doi.org/10.2339/politeknik.1464250.

Binghubash, H. A., Juric, R., & Mughal, B. (2016). Semantic selection of healthcare apps. In *2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 3278–3287). IEEE. https://doi.org/10.1109/HICSS.2016.410.

Bruce, C. R., Harrison, P., Nisar, T., Giammattei, C., Tan, N. M., Bliven, C., ... Schwartz, R. (2020). Assessing the impact of patient-facing mobile health technology on patient outcomes: Retrospective observational cohort study. *JMIR mHealth and uHealth, 8*(6), Article e19333. https://doi.org/10.2196/19333.

Caulley, L., Hunink, M. G., Randolph, G. W., & Shin, J. J. (2021). Evidence-based medicine in otolaryngology, Part XI: Modeling and analysis to support decisions. *Otolaryngology–Head and Neck Surgery, 164*(3), 462–472. https://doi.org/10.1177/0194599820948827.

Chen, H., Zhang, Y., Zhang, S., & Lyu, T. (2023). Exploring the role of gamified information security education systems on information security awareness and protection behavioral intention. *Education and Information Technologies, 28*(12), 15915–15948. https://doi.org/10.1007/s10639-023-11728-0.

Crompton, H., & Burke, D. (2018). The use of mobile learning in higher education: A systematic review. *Computers & Education, 123*, 53–64. https://doi.org/10.1016/j.compedu.2018.04.007.

Da Silva Monte, M. B., Morais, D. C., & de Farias Gomes, S. (2017). A value-focused consumer's perspective with multiattribute evaluation of the water distribution system of a Brazilian city. In *2017 IEEE international conference on systems, man, and cybernetics (SMC)* (pp. 3350–3355). IEEE. https://doi.org/10.1109/SMC.2017.8123147.

Dhlamini, E. J., & Mearns, M. A. (2019). Evaluation of coursework information access and sharing on smart devices by postgraduate students. *SA Journal of Information Management, 21*(1), Article 991. https://doi.org/10.4102/sajim.v21i1.991.

Dooley, P. P., Levy, Y., Hackney, R. A., & Parrish, J. L. (2018). Critical value factors in business intelligence systems implementations. In Y. Levy & I. D. G. Foster (Eds.), *Analytics and data science* (pp. 55–78). Springer. https://doi.org/10.1007/978-3-319-58097-5_6.

Eschenbrenner, B. (2019). Identifying essential factors for deriving value from big data analytics in healthcare. In *HCI in business, government and organizations. Information systems and analytics* (pp. 189–198). Springer. https://doi.org/10.1007/978-3-030-22338-0_15.

Françozo, R. V., & Belderrain, M. C. N. (2022). A problem structuring method framework for value-focused thinking. *EURO Journal on Decision Processes, 10*, Article 100014. https://doi.org/10.1016/j.ejdp.2022.100014.

Françozo, R. V., Carrapateira, E. S., da Silva, A. C. S., Belderrain, M. C. N., Ramos, V. D. S., dos Santos, J. J. M., & Leite, A. H. D. S. (2024). Avaliação de projetos em feiras científicas estudantis combinando value-focused thinking e analytic hierarchy process [Evaluation of projects in student scientific fairs combining value-focused thinking and analytic hierarchy process]. *Revista de Gestão e Secretariado, 15*(1), 498–515. https://doi.org/10.7769/gesec.v15i1.3360.

Françozo, R., Paucar-Caceres, A., & Belderrain, M. C. N. (2022). Combining value-focused thinking and soft systems methodology: A systemic framework to structure the planning process at a special educational needs school in Brazil. *Journal of the Operational Research Society, 73*(5), 994–1013. https://doi.org/10.1080/01605682.2021.1880298.

Gallivan, M. J. (2019). Author highlights for the past 35 years. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems, 50*(1), 54-76. https://doi.org/10.1145/3312576.3312586.

Gao, S., Li, Y., & Guo, H. (2019). Understanding the value of MOOCs from the perspectives of students: A value-focused thinking approach. In *Challenges and opportunities in the digital era* (pp. 129–140). Springer. https://doi.org/10.1007/978-3-030-02131-3_13.

International Telecommunication Union. (2023). *Measuring digital development: Facts and figures 2023*. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2018.aspx

Jafari, S., & Mushi, R. (2016). Promoting voluntariness on technology usage in organisations: A mobile technology perspective. *International Journal of ICT Research in Africa and the Middle East, 5*(2), 38–48. https://doi.org/10.4018/IJICTRAME.2016070104.

James, F., & Figaro-Henry, S. (2017). Building collective leadership capacity using collaborative 21st-century digital tools. *School Leadership & Management, 37*(5), 520–536. https://doi.org/10.1080/13632434.2017.1367277.

Kalaian, S. A. (2017). Distance and online learning. In *Handbook of research on instructional systems and educational technology* (pp. 23–36). IGI Global. https://doi.org/10.4018/978-1-5225-2399-4.ch003.

Kalaian, S. A. (2017). Pedagogical approaches for 21st-century student-driven learning in STEM classrooms. In *Student-driven learning strategies for the 21st century classroom* (pp. 72–86). IGI Global. https://doi.org/10.4018/978-1-5225-1689-7.ch006.

Kalaian, S. A. (2021). Distance and online learning. In *Research anthology on developing effective online learning courses* (pp. 16–28). IGI Global. https://doi.org/10.4018/978-1-7998-8047-9.ch002.

Karim, R. A., Adnan, A. H. M., Salim, M. S. A. M., Kamarudin, S., & Zaidi, A. (2020). Education innovations through mobile learning technologies for the Industry 4.0 readiness of tertiary students in Malaysia. *IOP Conference Series: Materials Science and Engineering, 917*(1), Article 012022. https://doi.org/10.1088/1757-899X/917/1/012022.

Klapper, L. (2019, November 21). *Mobile phones are key to economic development. Are women missing out?* Brookings Institution. https://www.brookings.edu/articles/mobile-phones-are-key-to-economic-development-are-women-missing-out/.

Krishen, A. S., Kachen, S., Kraussman, M., & Haniff, Z. (2016). Do consumers dig it all? The interplay of digital and print formats in media. *Journal of Consumer Marketing, 33*(7), 489–497. https://doi.org/10.1108/JCM-01-2015-1287.

Kukulska-Hulme, A. (2020). Mobile-assisted language learning [Revised edition]. In C. Chapelle (Ed.). *The concise encyclopedia of applied linguistics*. Wiley.

Kunz, R. E., Siebert, J., & Mütterlein, J. (2016). Combining value-focused thinking and balanced scorecard to improve decision-making in strategic management. *Journal of Multi-Criteria Decision Analysis, 23*(5–6), 225–241. https://doi.org/10.1002/mcda.1572.

Kwon, C., Butler, D., Uchidiuno, J. O., Stamper, J., & Ogan, A. (2024). Investigating demographics and motivation in engineering education using radio and phone-based educational technologies. In *Proceedings of the 2024 CHI conference on human factors in computing systems* (pp. 1–15). Association for Computing Machinery. https://doi.org/10.1145/3613904.3642221.

Larreta Ramírez, E. V., Gastelum Chavira, D. A., Leyva López, J. C., & Ahumada Valenzuela, O. (2020). Structuring and creating alternatives for the eggplant loss problem using the value-focused thinking methodology. *Inquietud Empresarial, 20*(2), 53–71. https://doi.org/10.19053/01211048.11208. .

Moore, M. G., & Diehl, W. C. (2019). *Handbook of distance education* (4th ed.). Routledge.

Muller, J. (2020). *Share of population owning a mobile phone in Indonesia from 2010 to 2018*. Statista. https://www.statista.com/statistics/1084069/indonesia-share-of-population-owning-a-mobile-phone/.

Mushi, R. M., & Lillis, D. (2016a). Metrics for assessing adoption of mobile phone technology in SMEs: A case of Tanzania. In *2016 International Conference on Engineering, Technology and Innovation/IEEE International Technology Management Conference (ICE/ITMC)* (pp. 1–6). IEEE. https://doi.org/10.1109/ICE.ITMC39735.2016.9026094.

Mushi, R. M., & Lillis, D. (2016b). Exploring values of mobile phone technology in SMEs: A case of Tanzania tourism sector. In *2016 International Conference on Engineering, Technology and Innovation/IEEE International Technology Management Conference (ICE/ITMC)* (pp. 1–13). IEEE. https://doi.org/10.1109/ICE.ITMC39735.2016.9025898.

Ogundaini, O., & Mlitwa, N. B. W. (2023). A post-pandemic analysis of m-learning outcomes towards transformation in Sub-Saharan Africa. In *ICERI2023 Proceedings* (pp. 8004–8011). IATED.

Osakwe, J. O., Ujakpa, M., Iyawa, G., & Florich, K. (2019). Enabling quality education in Namibia through mobile learning technologies. In *2019 IST-Africa Week Conference (IST-Africa)* (pp. 1–9). IEEE.

Pacheco, B. C. S., Françaço, R. V., Piratelli, C. L., Belderrain, M. C. N., & Amaral, A. C. (2019). Value focused performance indicators for graduate programs. *Pesquisa Operacional, 39*(3), 497–519. https://doi.org/10.1590/0101-7438.2019.039.03.0497.

Pamplona, D. A., & Alves, C. J. P. (2020). An overview of air delay: A case study of the Brazilian scenario. *Transportation Research Interdisciplinary Perspectives, 7*, Article 100189. https://doi.org/10.1016/j.trip.2020.100189.

Park, Y. (2019). An analysis of the technology acceptance model in understanding university students' behavioral intention to use mobile learning. *Educational Technology & Society, 22*(3), 132–145.

Parks, R. F., Wigand, R. T., & Benjamin Lowry, P. (2022). Balancing information privacy and operational utility in healthcare: Proposing a privacy impact assessment (PIA) framework. *European Journal of Information Systems, 32*(6), 1052–1069. https://doi.org/10.1080/0960085X.2022.2103044.

Picoto, W. N., Bélanger, F., & Palma-dos-Reis, A. (2017). An organizational perspective on m-business: Usage factors and value determination. *European Journal of Information Systems, 23*(5), 571–592. https://doi.org/10.1057/ejis.2014.15.

Raney, M. A. (2016). Dose- and time-dependent benefits of iPad technology in an undergraduate human anatomy course. *Anatomical Sciences Education, 9*(4), 367–377. https://doi.org/10.1002/ase.1581.

Rashid, N. S. A., Chen, X. W., Mohamad Marzuki, M. F., Takshe, A. A., Okasha, A., Maarof, F., & Yunus, R. M. (2022). Development and usability assessment of a mobile app (Demensia KITA) to support dementia caregivers in Malaysia: A study protocol. *International Journal of Environmental Research and Public Health, 19*(19), Article 11880.

Reeves, J. L., Gunter, G. A., & Lacey, C. (2017). Mobile learning in pre-kindergarten: Using student feedback to inform practice. *Journal of Educational Technology & Society, 20*(1), 37–44.

Shukla, S., Mohanty, B. K., & Kumar, A. (2018). Strategizing sustainability in e-commerce channels for additive manufacturing using value-focused

thinking and fuzzy cognitive maps. *Industrial Management & Data Systems, 118*(2), 390–411. https://doi.org/10.1108/IMDS-03-2017-0122.

Siau, K., & Chen, X. (2016). Technology-mediated synchronous virtual education. *Journal of Database Management, 27*(4), 39–63. https://doi.org/10.4018/JDM.2016100103.

Siau, K., & Ling, M. (2017). Mobile collaboration support for virtual teams. *Journal of Database Management, 28*(3), 48–69. https://doi.org/10.4018/JDM.2017070103.

Stevens, T., Gkountouna, O., & Lee, M. (2022). Exploring secondary teachers' needs and values in culturally responsive teaching. In *Companion publication of the 2022 Conference on Computer Supported Cooperative Work and Social Computing* (pp. 140–144). Association for Computing Machinery. https://doi.org/10.1145/3500868.3559473.

Traxler, J. (2018). Distance learning—Predictions and possibilities. *Education Sciences, 8*(1), Article 35. https://doi.org/10.3390/educsci8010035.

Tuhkala, A., Isomäki, H., Hartikainen, M., Cristea, A., & Alessandrini, A. (2018). Design of a learning space management system for open and adaptable school facilities. In *Computers supported education* (pp. 22–43). Springer. https://doi.org/10.1007/978-3-319-94640-5_2.

Uchidiuno, J., Yarzebinski, E., Madaio, M., Maheshwari, N., Koedinger, K., & Ogan, A. (2018, June). Designing appropriate learning technologies for school vs home settings in Tanzanian rural villages [Paper presentation]. In *Proceedings of the 1st ACM SIGCAS Conference on Computing and Sustainable Societies* (pp. 1–11). Association for Computing Machinery.

UNESCO. (2023). *Global education monitoring report 2023: Technology in education*. UNESCO Publishing.

Van Deursen, A. J., & van Dijk, J. A. (2019). The first-level digital divide shifts from inequalities in physical access to inequalities in material access. *New Media & Society, 21*(2), 354–375. https://doi.org/10.1177/1461444818797082.

Vassilakaki, E., Moniarou-Papaconstantinou, V., & Garoufallou, E. (2016). Identifying the uses of mobile technology among Library and Information Science undergraduate students. *Program, 50*(4), 417–430. https://doi.org/10.1108/PROG-10-2015-0069.

Xie, X., Siau, K., & Nah, F. F.-H. (2020). COVID-19 pandemic—Online education in the new normal and the next normal. *Journal of Information Technology*

Case and Application Research. Advance online publication. https://doi.org/10.1080/15228053.2020.1824884.

Yang, H. H., Shi, Y., Yang, H., & Pu, Q. (2020). The impacts of digital note-taking on classroom instruction: A literature review. In *Technology in education. Innovations for online teaching and learning* (pp. 61–72). Springer. https://doi.org/10.1007/978-981-33-4594-2_6.

Zou, C., Zhao, W., & Siau, K. (2020). COVID-19 pandemic: A usability study on platforms to support eLearning. In *HCI International 2020 – late breaking posters* (pp. 333–340). Springer. https://doi.org/10.1007/978-3-030-60703-6_43.