Usability of Mobile Learning Technologies in Open and Distance Learning

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Abstract

Mobile learning (m-learning) utilizes portable devices like smartphones and tablets for educational purposes and is gaining popularity, particularly in open and distance learning (ODL) contexts. This study explores the usability of mobile learning technologies among undergraduate students in ODL. An online survey questionnaire was administered to undergraduates enrolled in a Business course in Botswana and a usability conceptual model was developed. The findings revealed that predominant opportunities of using mobile learning technologies in ODL include improved student interaction and flexible learning schedules. Likewise, challenges embraced limited battery life, small screens, distractions from phone calls and notifications, and the high cost of internet bundles. To enhance adoption of mobile learning, the study recommends investments in infrastructure and internet connectivity. Furthermore, it suggests reducing internet costs through initiatives like government subsidies or partnerships with Telecom providers. Additionally, the study highlights the importance of training ODL educators and students in effective mobile learning technology utilization.

Keywords: Mobile learning technologies, Mobile learning, Usability, Open and Distance learning, Higher Education

1. INTRODUCTION

Technology is rapidly advancing in all aspects of modern society including education. Mobile learning is the 21st century learning, which provides a framework for ubiquitous learning and access to anywhere learning and any time teaching. The number of mobile devices has drastically inflated, which has led to a high number of research with focus on the usability of mobile technologies as a learning tool and [1].The enhancement of innovation and technology together with its expectations has resulted in discovery of novel strategies to enhance teaching

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and learning in distance higher education. The widespread adoption of information technology (IT) in education has contributed to an improvement in students' academic performance, as well as their computer literacy skills [2].

Botswana, like many other developing countries, faces some challenges in providing quality and accessible open and distance learning. The provision of ODL in Botswana has emerged as a viable solution to expand educational opportunities in the country (source). In recent years, the use of mobile learning technologies has gained prominence in Botswana as a result of their potential to overcome geographical barriers and enhance learning experiences. However, there is limited research on the application and effectiveness of mobile learning technologies in the specific context of ODL in Botswana.

Botswana faces significant challenges in providing equitable access to higher education, particularly in rural areas where traditional classroom-based learning is limited. According to the Statistics Botswana Education Report (2022), only 28% of students in remote areas have access to higher education institutions, primarily due to geographic and financial constraints. The Botswana National E-Government Strategy (2021-2026) highlights mobile learning as a key solution to bridge this gap by offering flexible, cost-effective education.

Additionally, a study by [3] found that 74% of distance learners in Botswana rely on mobile devices to access course materials, but 56% struggle with high internet costs and unreliable connectivity. The increasing adoption of mobile learning is further supported by a 2023 report from the Botswana Communications Regulatory Authority (BOCRA), which indicates that mobile internet penetration in the country has reached 72%, making digital learning a viable option. These statistics underscore the urgent need for affordable and well-supported mobile learning initiatives to improve access to education, particularly for students in remote and underserved areas.

In recent years, the world has witnessed a drastic rise in the use of mobile devices such as smartphones, iPad and hand phones [3] . The increasing number of mobile technologies and its usability facilitated by the internet has triggered innovative opportunities for their usage in higher education [4]. According to [5] the rate of mobile internet penetration is predicted to rise up to 71% of the world population by the year 2025. The high uptake of mobile devices amongst students has made it essential for institutions around the world to innovatively integrate mobile technologies in teaching and learning practices [6]. Mobile devices provide e-learning opportunities for portable and small wireless devices. This has also enhanced delivery of knowledge through digital learning from distance learning to electronic learning (e-learning) and in modern mobile learning pedagogies.

1.1. Mobile Learning

Mobile learning is defined as learning across multiple contexts, through social and content interactions using personal electronics devices [7]. Mobile learning takes place when learners are not in a selected setting and when learners benefit from mobile technologies opportunities and advantages [8]. Mobile learning makes it possible for students to allow them to take advantage of their mobile technologies [8]. Mobile learning is also described as a subtopic of e-learning management through portable digital devices [9] describes mobile learning as one of the branches of distance education which is directly affected by technological developments. It is seen as a huge and extraordinary evolution towards the availability of teaching and e-learning for students through a common means of communication amongst learners [9], [10] . The usability of mobile technologies would bring about continuity in learning independent of the location of the student [8]. Research on teaching and learning through mobile learning has become a rapidly evolving area [11]. The advances in mobile technology and its hasty development into electronic devices such as tablets and smart-phones had shaped the learning process in higher education. Research also indicates that mobile technologies support learners in a variety of ways [12], which includes facilitating them throughout the education process.

1.2. Open and Distance Learning

Open and distance learning (ODL) aims to bridge the gap in the world of higher education which has been created by geographical and social factors, education, communication and economic factors. ODL has grown into an important global strategy that resolves the problem of access to education. However, ODL has faced some unique challenges such as late completion of programs and a high number of dropouts [13]. Several studies on mobile learning technologies, usability of mobile learning, and mobile learning application frameworks have already been undertaken. Different research studies have been conducted with focus on factors affecting mobile learning in developed countries, However, little research has been done in the context of developing countries [14]. This study fills this gap by providing a better understanding of usability of mobile learning and mobile learning technologies in the context of ODL in Botswana.

1.3. The Study Objectives

The objectives of this study were to;
　　1)　To assess the usability of mobile learning platforms and technologies in the context of open and distance learning among undergraduate students.

2) To identify the challenges and barriers associated with the adoption and integration of mobile learning in open and distance learning among undergraduate students.
3) To provide recommendations for improving the design and implementation of mobile learning strategies in open and distance learning environments for undergraduate students.

1.4. Research Questions

The study answered the following questions which are;
1) How usable are mobile learning platforms and technologies in the context of open and distance learning among undergraduate students?
2) What challenges and barriers hinder the adoption and integration of mobile learning in open and distance learning among undergraduate students?
3) What recommendations can be made to improve the design and implementation of mobile learning strategies in open and distance learning environments for undergraduate students?

The study on mobile learning technologies usability employed several theoretical frameworks to analyze user adoption and experience. The Technology Acceptance Model (TAM) [15] was used to assess students' perceptions of ease of use and usefulness, which are key factors in technology adoption. Additionally, the System Usability Scale (SUS) [15] was applied to measure overall system usability, including efficiency, learnability, and satisfaction. The Unified Theory of Acceptance and Use of Technology (UTAUT) [16] further provided insights into the role of social influence and facilitating conditions in mobile learning adoption. These models collectively helped evaluate the usability challenges and opportunities of mobile learning technologies in open and distance learning (ODL) environments.

1.5. Research Gap and Contribution of Findings

Despite the increasing adoption of mobile learning (m-learning) technologies in higher education, limited research has been conducted on their usability within the context of Open and Distance Learning (ODL) in Botswana. Existing studies on m-learning usability predominantly focus on developed countries, where infrastructure and technological resources are more advanced [17]. However, there is a lack of empirical studies examining the specific challenges faced by students in developing countries, particularly in terms of internet affordability, device limitations, and institutional support.

This study bridges the gap by providing empirical evidence on how students perceive and experience mobile learning technologies. The findings reveal key

usability barriers, such as high internet costs, network connectivity issues, limited battery life, and distractions from mobile applications, which are often overlooked in global m-learning research. Moreover, the study identifies opportunities for enhancing mobile learning, such as flexible learning schedules and improved student interaction. By addressing these gaps, the study contributes to the design and implementation of mobile learning strategies tailored to the ODL context in Botswana. The recommendations, including infrastructure investment, cost reduction initiatives, and digital literacy training, provide a practical framework for policymakers and educational institutions to improve mobile learning usability and enhance student engagement in distance learning.

1.6. Related Work

In the recent past, distance education has profoundly gained high attention in most empirical studies conducted in different contexts of the world. In the development of distance learning, technology has also played a significant role. Today distance learning has evolved and now a robust mobile learning strategy is delivered wirelessly to students in a mobile virtual classroom[18]. There are different types of technologies that are used in the learning process which are usually known as educational technologies. These technologies are; educational technologies, instructional design technologies and behavioral technology. Educational technologies make use of e-learning technologies which are mobile based technologies. Mobile learning is an important part of e-learning technologies which is widely used in most distance institutes and open universities around the world. Open universities and distance education institutions make use of technology-based learning that caters for collaboration, connectivity and flexibility. The advancements of technologies have modernized distance learning as teaching and communication takes place in a more advanced and different setting [19].

Learners use technology-based devices such as laptops and computers to engage in a mobile environment. Studies show that mobile phones help to improve the access to the information regardless of students' location [20]. Learners attend classes with the latest mobile devices which include smartphones and notebooks. Nonetheless, faculty members are not prepared for the introduction of mobile learning devices in the classroom. University instructors are not sure of mobile learning technology usability, their policies, classroom management, whether not to allow them or embrace mobility.

Mobile technologies have penetrated the education system and have been used for the past two decades [21]. Mobile learning and mobile learning technologies motivates learners and supplements the learning environment by making it interesting and more effective [21] . Mobile learning technologies provide a platform where learners could collaborate and informally communicate. It

improves the flexibility of distance education when combined with a blended approach [22].

Although Mobile learning and mobile learning technologies are not new, since the emergence of COVID 19, there has been a massive shift from the traditional classroom environment to online learning. Affordability and easy to use mobile devices has also encouraged this shifting from stand-alone computers to mobile devices. The usability of mobile learning and mobile learning technologies can be evaluated looking at aspects such as system usability scale and technology acceptance model amongst others [23]. [24] describes the usability of a mobile technology as its capability to be used and fully understood by the end user. The system usability state can be evaluated by getting the feedback from the system's end users [25]. In addition to the end user's feedback, there are other several attributes that constitutes to the overall usability such as error frequency, learnability and efficiency [26]. Adaptation also plays an important role in the usability of a mobile application [27].

In a study by [28], they evaluated the usability of Microsoft teams as their e-learning platform. The findings of their study showed a neutral rating, this as a result showed that Microsoft Teams may or may not be as positive as expected in terms of learning experience for the students and this was due to the limited utilization of the platform. In a similar study conducted by [29] regarding the usability of MS Teams across the globe not only limited to educational purposes, the study showed a positive feedback as there was a 41% increase during the COVID 19 pandemic. The study showed that a huge number of organizations worldwide had adopted MS Teams.

In another study by [30], [29] WhatsApp was used to support learning and teaching in the university. The results showed positive feedback when it comes to the interaction between teachers and the students. In a similar investigation on the usability of WhatsApp by [31], the results showed that WhatsApp can be one of the creative teaching techniques to attract students and provide them with a fun-based-learning environment when they conducted a study on 20 university students. Results showed that idea contribution among students and faster and easier communication between students and teachers can be achieved. A study by [32] also stated that WhatsApp proved to play a vital role in enhancing learning through mobile technology.

Another study by [33], [34] reviewed mobile learning in higher learning based on the African perspective, the results showed that mobile learning within higher education institutions in Africa increased collaboration between students and lecturers. However, findings also indicated significant challenges in integrating

mobile learning in higher education institutions within Africa due to poor technological infrastructure and lack of access to modern mobile devices.

Although several studies applaud the usability of mobile learning and mobile learning technologies, [35] in contrast argued that there is poor usability of existing mobile learning systems and due to limited screen size, and small input interfaces amongst others. A study by [36] also stressed that there is poor usability of mobile learning technologies due to poor readability which results from small screen sizes of mobile devices.

2. METHODS

This study employed a descriptive research design to examine the usability of mobile learning technologies in Open and Distance Learning (ODL). A descriptive approach was selected because it allows for an in-depth understanding of the experiences, challenges, and benefits associated with mobile learning technologies among students. Descriptive research has been widely applied in educational technology studies to assess usability and adoption patterns [36]. This approach was effective in capturing students' perspectives on mobile learning, helping to generate recommendations for improving digital learning experiences [37].

The target population for this study consisted of undergraduate students enrolled in ODL programs. These students were selected because they frequently rely on mobile devices to access course materials and engage in virtual learning. A convenience sampling technique was used, allowing for easy access to respondents willing to participate. A total of 40 students participated in the study, with a gender distribution of 36% male and 64% female. The students' age groups varied, with the majority falling between 41-50 years (47.5%), followed by 31-40 years (30%). Convenience sampling is commonly used in mobile learning research due to its efficiency in collecting data from a readily available group [38].

Data was collected using an online survey questionnaire, designed to evaluate key aspects of mobile learning usability. The questionnaire consisted of both closed-ended and open-ended questions, focusing on device preferences, learning efficiency, usability challenges, and students' perceptions of mobile learning. The survey was structured based on usability principles defined by [17], ensuring that all critical aspects of mobile learning were covered. The questionnaire was distributed via online platforms, allowing participants to complete it remotely at their convenience. Online surveys are particularly effective in e-learning studies as they facilitate data collection from geographically dispersed participants [39].

The survey data in this study was analyzed using Microsoft Excel, both widely used in educational and usability research. Microsoft excel was employed for descriptive statistics, such as frequency distributions, means, and standard deviations, to

interpret trends in mobile learning technologies adoption. Microsoft Excel was used for data cleaning, visualization, and basic trend analysis, making it easier to identify key patterns in students' responses. The choice of SPSS is justified due to its robust statistical capabilities, ease of use, and reliability in handling large datasets, while Excel provided a quick and accessible platform for summarizing findings. These tools ensured an accurate and comprehensive analysis of mobile learning usability in Open and Distance Learning (ODL).

3. RESULTS AND DISCUSSION

The research questions of this study were addressed under the following subsections:

3.1. Demographics

Table 1 illustrates the gender profile of the respondents. Out of 40 respondents, 36% were male while 64% were female.

Table 1. Gender Profile

Gender	Number of respondents	Percentage
Male	18	36%
Female	32	64%
Total	40	100%

The age profile of the respondents is represented in Table 2. The greatest number of respondents (47.5%) was found in the age group 41-50 years, followed by (30%) 31-40 age group. The smallest number of respondents (5%) was from the age group under 20 years and (5%) age 21-30.

Table 2. Age Profile

Age (in years)	Number of Respondents	Percentage
< 20	2	5%
21- 30	2	5%
31- 40	12	30%
41-50	19	47.5%
51 and above	5	12.5%
Total	40	100%

Table 3 presents respondents' professional experience in years. The highest number of respondents (52.5%) has 21-30 years of professional experience, followed by (17.5%) 11-20 years of experience. The smallest (2.5%) has less than 5 years of professional working experience.

Table 3. Professional Experience

Experience (in years)	Number of Respondents	Percentage
<5	1	2.5%
5-10	5	12.5%
11-20	7	17.5%
21-30	21	52.5%
>30	6	15%
Total	40	100%

Table 4 shows that a high number of respondents (85%) use mobile devices to access educational content, while a lower number of respondents (15%) do not use mobile devices for educational content. This shows more students use mobile technologies to access educational content.

Table 4. Use of Mobile Devices to Access Education Content

Use of mobile device	Number of Respondents	Percentage
Yes	34	85%
No	6	15%
Total	40	100%

Table 5 shows that a high number of respondents (60%) prefer to use smartphones to access educational content, and (25%) prefer tablets and the rest of the respondents (15%) prefer other devices.

Table 5. Preferred Device to Access Educational Content

Preferred Device	Number of Respondents	Percentage
Smartphone	24	60%
Tablet	10	25%
E-book reader	0	0%
Other	6	15%
Total	40	100

Respondents showed reasons why they preferred to use devices from Table 5 above. Table 6 shows a high number of respondents (70%), find using mobile devices for educational content easy to use, followed by (60%) portable and the average number of respondents (50%), find mobile devices to be convenient and they have the ability to multitask. Respondents showed that readable content (30%), internet connectivity (30%) and ample screen size (20%) are not the reasons participants' use their preferred device for education content because they show a lower percentage.

Table 6. Reasons for using Preferred Mobile Device

Reasons for preferred device	Number of Respondents	Percentage
Easy to Use	28	70%
Portable	24	60%
Readable Content	12	30%
Convenient	20	50%
Ability to multitask	20	50%
Ample screen size	8	20%
Internet connectivity	12	30%

Table 7 shows that respondents find efficiency (65%) as the most important usability principle when using mobile technologies for educational purposes, followed by satisfaction (15%).

Table 7. The most important usability principle

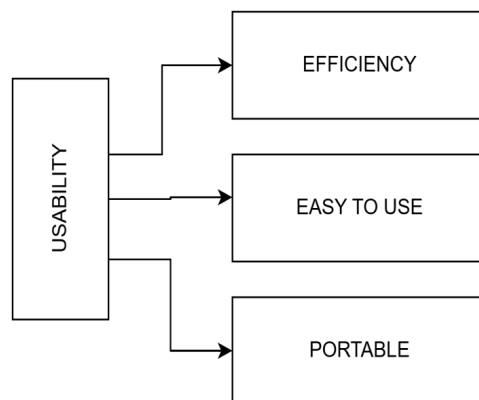| Usability Principle	Number of Respondents	Percentage
Satisfaction	6	15%
Learnability	4	10%
Efficiency	26	65%
Memorability	0	0%
Errors	4	10%
Total	40	100

Figure 1. Conceptual Usability Model

Table 8 shows problems encountered by respondents while using mobile technologies for educational purposes. There are some respondents who find using mobile technologies costly as some find buying internet bundles pricey. Respondents face Network issues while accessing education content especially

those that stay in places out of the city. Using mobile devices is a disadvantage because of short battery life, small screen, memory shortage to store education content such as notes and e-books and lastly distraction from phone calls and other applications during lessons.

Table 8. Problems encountered when using mobile devices for education

S/N	Problems Encountered
1	Costly: buying internet bundles as a student can be costly
2	Network issues: for places out of the city
3	Small screen
4	Distractions from other applications like social media, phone calls and SMS and interaction with other applications
5	Memory shortage: because of large files to be downloaded such as e-books lecture videos
6	Short battery life
7	lack of access to software needed for education content

The challenges and opportunities of mobile learning and mobile learning technologies in ODL. There are some of the challenges that still need to be addressed for distance learning and open universities for the successful implementation of mobile learning and mobile learning technologies. These challenges include; lack of technological support, unfriendly institutional policies on mobile learning and mobile learning technologies and lack of support from instructional design for mobile learning and mobile learning technologies [40], [41].

Other challenges of mobile learning technologies include small keyboards of mobile devices which leads to difficult typing and fear of using technology. Some instructors are unwilling to incorporate mobile learning technologies while others need training on integrating mobile technologies in the classroom. There are also data privacy concerns and financial constraints among students, which also inhibit mobile technology inclusion in higher distance education. Some institutions also lack access to mobile technologies as they may not own it, therefore may not properly incorporate it or use it effectively [42]. There is inadequate support from universities in terms of policy, instructional design instruments and infrastructure for the successful integration of mobile learning technologies in classroom teaching pedagogies.

3.2. Discussion

Using mobile learning technologies is viewed as time saving and a great alternative to the traditional ways of teaching [43]. Other opportunities include enhanced student collaboration as students are able to work together virtually in

geographically disparate locations. Mobile learning technologies are able to bridge the digital gap because mobile devices are more affordable to the larger population as compared to bigger devices like computer desktops. Most learners find them portable and are easy to carry. Students can interact easily with one another and with the instructor outside of the typical classroom environment.

Mobile learning helps to enhance learner retention and helps them to complete their course while addressing their individual learning needs with flexibility [43], [43]. Mobile learning and mobile learning technologies are viewed as an extension of e-learning and if implemented in a strategic way, mobile learning technologies can add value and complete the existing e-learning models and theories. Table 9 show the Justification for the Mobile Learning Optimization System (MLOS) as opportunities for mobile learning and mobile learning technologies in ODL.

Table 9. Justification for the Mobile Learning Optimization System (MLOS)

Technology	Purpose	Countries Implementing It	Impact on Education
AI-Driven Adaptive Learning	Personalizes education by analyzing student performance and adjusting learning content in real time.	United States, China, Finland	Increased retention rates, better student engagement, and reduced dropout rates in ODL programs.
Blockchain for Credential Verification	Ensures tamper-proof, decentralized academic records that can be accessed globally.	Estonia, Singapore, UAE	Secure, instant degree verification reduces fraud and enhances employer trust in online education.
Edge Computing for Real-Time Access	Reduces latency and dependence on centralized servers, improving mobile learning in low-network areas.	South Korea, Germany, Japan	Faster access to learning resources, improved rural education, and reduced mobile data costs.

AI-driven adaptive learning is transforming education by making it more interactive, student-centered, and efficient. AI analyzes learning patterns, engagement levels, and assessment results to dynamically adjust the difficulty and type of content presented to learners. For instance, China's AI-powered tutoring systems, such as Squirrel AI, provide students with real-time feedback and personalized study plans, reducing failure rates by 30% [44]. Similarly, Finland's

AI-driven mobile learning platforms have improved student engagement in rural areas by 40% (OECD, 2022).

In contrast, Botswana lacks AI-driven mobile learning systems, resulting in generalized, static course delivery that does not cater to individual learning needs. To close this gap, higher education institutions should invest in AI-powered platforms that personalize learning, track student performance, and adapt teaching methods accordingly. This will enhance retention and completion rates, particularly in rural communities with limited teacher interaction. Blockchain ensures secure, verifiable academic records that cannot be altered or forged. Countries like Singapore use blockchain-based credentialing systems to issue digital certificates, making degree verification instant and globally recognized [45]. In Dubai, blockchain is integrated into higher education to eliminate fake degrees, a system that has reduced fraudulent credentials by 70% (UNESCO, 2023).

Botswana still relies on manual verification of qualifications, which leads to delays, fraud risks, and inefficiencies in recruitment. Implementing a national blockchain academic ledger would allow students to instantly verify their credentials, reducing administrative bottlenecks and enhancing the global credibility of Botswana's education system. Government-university partnerships with blockchain firms could accelerate this adoption. Edge computing processes educational data closer to the user, minimizing network dependency and latency issues. South Korea has integrated edge computing into mobile learning systems, ensuring seamless content delivery in rural regions (Korea Internet & Security Agency, 2023). In Germany, edge computing has improved digital education by 30% in underdeveloped regions [46].

In Botswana, mobile learning is hindered by slow internet speeds and high data costs, especially in rural areas and when the country experience rain fall and heavy floods. the technology infrastructure in Botswana still does not support mobile technology network even in towns near the capital city. Deploying edge nodes in educational institutions can decentralize content distribution, improving access and reducing reliance on unstable internet connections. Botswana can adopt a hybrid cloud-edge model to ensure seamless mobile learning experiences nationwide. While developed nations have successfully adopted artificial intelligence (AI)AI-driven learning, blockchain credentialing, and edge computing, Botswana and similar developing countries still struggle with mobile learning accessibility, verification systems, and connectivity. Governments should prioritize policy changes that support the integration of AI, blockchain, and edge computing into digital education systems.

Develop National AI Strategies for Mobile Learning – The Ministry of Education should collaborate with AI companies to implement machine learning-driven

platforms for personalized education. AI can enhance student engagement, especially in large-scale ODL programs where direct teacher supervision is limited. Establish a Blockchain-Based Credential Verification System – Botswana should create a centralized blockchain registry for all academic institutions, ensuring secure, tamper-proof degree verification. This can be implemented through partnerships with tech companies like IBM Hyperledger or Ethereum Blockchain for Education.

Deploy Edge Computing in Rural Learning Centers – To overcome poor internet access, Botswana should invest in edge servers at universities and rural learning centers, reducing lag in digital classrooms and optimizing mobile data consumption. By adopting these recommendations, Botswana can bridge the digital divide, enhance mobile learning usability, and establish a globally competitive education system. The COVID-19 pandemic exposed the urgency of digital transformation in education, proving that the use of mobile learning innovations is no longer optional but essential. Countries that fail to integrate AI, blockchain, and edge computing will struggle to keep up with global education standards. Now is the time for Botswana and other developing nations to invest in the future of mobile learning.

Mobile learning technologies have not reached their potential yet in the education sector and there is need to be further explored and researched. Mobile phones to date are the most used forms of communications as compared to other devices. More people are eager to explore mobile technologies for educational purposes. Particularly the study explores the challenges and opportunities students face during learning in the ODL environment. Results of the study showed that most students in Botswana use mobile technologies to access educational content, therefore, the integration of mobile learning technologies in ODL pedagogies should be considered to improve distance learning curricula. Furthermore, findings revealed that a large number of students found using mobile technology devices for education content as 'Easy to Use' and 'Portable' as it enables them to access learning resources virtually and conveniently. The introduction of mobile learning and mobile learning technologies can transform ODL in Botswana by providing access to quality learning at flexible schedules, and education in a cost-effective manner.

The study also identified numerous challenges involved with the usability of mobile learning and mobile learning technologies in ODL which includes; the high cost of mobile technologies, the high cost of purchasing internet bundles, mobile device short battery life, distraction from phone calls and notifications, and limited storage memory in mobile devices. Other respondents in rural locations had pointed out that they face network connectivity issues and slow internet connections. However, despite the aforementioned challenges incurred in the

usability of mobile technologies in distance learning, mobile technologies are perceived as great tools amongst learners and instructors, which also play a critical role in economic growth and provide seamless internet communication. Mobile devices have a huge impact in every field from education, business, agriculture and currently growing in all sectors. Therefore, mobile technologies could enhance learner online team collaboration, boost learner retention and motivations towards distance education globally.

Based on the research findings, the following recommendations are suggested to improve the usability of mobile learning technologies among undergraduate students:

1) Connectivity Improvement: There is a need to invest in infrastructure and internet connectivity to ensure that there is seamless access to mobile learning resources.
2) Digital Literacy Training: One of the most important issues is to make sure that comprehensive digital literacy training programs are made available to both the learners and educators to enhance their proficiency in using mobile learning devices.
3) Cost Reduction: This is another critical component that needs to be addressed. The cost of accessing the internet should be reduced through various initiatives like government subsidies or partnerships with telecommunications providers.
4) Pedagogical Training: This is a great initiative that can be used to support ODL educators in gaining more insights and knowledge regarding pedagogical strategies that can be used to maximize the effectiveness of mobile learning technologies.

In future studies, we aim to focus on expanding our conceptual model by developing a hybrid usability framework for mobile learning technologies in education in general. The framework is envisaged to assist education policy makers and decision makers in distance education institutions by providing guidance in ways to fulfil their mission and vision, as well as to attain their long-term educational goals. The framework will also encourage the usability and adoption of mobile learning technologies by providing sets of rules that provide a supportive environment for both learners and instructors. the study will also look at driver of emerging technologies usability in education.

4. CONCLUSION

To bridge the research gap in Computer Information Systems (CIS) related to mobile learning in Open and Distance Learning (ODL), we propose a Mobile Learning Optimization System (MLOS) integrating AI-driven adaptive learning,

blockchain for credential verification, and edge computing for real-time access guided by the study conceptual model. This framework is crucial in enhancing accessibility and efficiency in digital education, particularly in developing nations like Botswana. The integration of these technologies has already transformed education in technologically advanced countries, demonstrating their potential to revolutionize mobile learning worldwide.

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