Learning with mobile devices - insights from a university setting in Ghana

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Abstract

Mobile learning is the newest and emerging technology embraced by universities and this seems to be fast establishing itself as the preferred mode of learning in many countries. However, ways in which mobile devices are used to meet learning goals seem under-researched and may require more effort from researchers, especially in the context of Africa. This empirical study sought to investigate the state of mobile usage among higher education students, their experiences, and available facilitating conditions that influence mobile learning in a Ghanaian university setting. A total of 222 students (distance and vacation students) were engaged to respond to the questionnaires employed for the study. Findings revealed that mobile learning exists in a somewhat structured form as the environment showed most of the salient characteristics of mobile learning but largely remained unharnessed. To a large extent, facilitating conditions for mobile learning were available; students showed positive experiences with their mobile devices and their use in accessing learning, but largely such learning did not occur via the deployed learner management system of the institution. Implications for policy formulation for the Institution and other similar ones that are striving to incorporate mobile technology to increase access and improve the quality of instruction delivery are discussed.

Keywords Distance education · Mobile learning · Facilitating conditions · Learning Management System (LMS)

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1 Introduction

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. In spite of the numerous potentials of mobile learning, it has received minimal attention and encouragement for its usage for teaching and learning particularly in Africa (Mtebe & Kondoro, 2016; Naidoo, 2017; Arthur-Nyarko et al., 2020), though much advancements in terms of telecommunication infrastructure have been seen in this field in a relatively short time across the globe. These improvements in mobile infrastructure are penetrating most African countries (even before the outbreak of COVID 19) and are bringing about conditions that are gradually turning into homes of emerging ICT hubs with Ghana not being an exception. Ghana was placed sixth amongst the first eight African countries identified with over 10 technology hubs (Kelly & Firestone, 2016; Ofori-Boateng, 2017). The total mobile data subscriptions and penetration rate at the end of the second quarter of 2021 were 22.85 million and 78.03% respectively (National Communications Authority (NCA), 2021). Phones owned by Ghanaians were 35,283,957 as of the close of 2015 representing a teledensity of 129.63% (Ghana Business News, 2016). This is just a little below the 2013 figures for the top 5 countries in the world-Hong Kong (1.89%), Russia (1.79%), Saudi Arabia (1.70), Lithuania (1.48%), and Estonia (1.48%) (Mitra, 2013). The Broad Band Wireless Access (BWA) subscription and penetration rate was 53,263, an increase of 0.31% over the first quarter of the previous year. (NCA, 2021). Ghana’s Internet providers constantly upgrade their technology to increase Internet access and speed. In relatively few years the providers have moved from GPRS to EDGE to 2G (Second Generation) to 3G (Third Generation) and are currently at 4G (Fourth Generation) with 5G (Fifth Generation) in the offing. The super high data rate, low latency, high mobility, high energy efficiency and high traffic density characterize 5G (Chih-Lih, Han, Xu, Sun & Pan, 2016). The newer the Generation the higher the speed of access, capacity for diverse media and higher peak capacity and low latency (Ashraf, 2019). This means that Ghanaians have relatively good internet connectivity. These figures together with some other favourable conditions in Ghana, a developing country, reveal a huge potential in harnessing mobile learning as the existing ICT environment could support it.

Ghanaian universities, however, are yet to explore the full potential of this environment as it appears most institutions are at the crossroads of adopting emerging technologies to increase access and improve instruction; already recent reports indicate that mobile learning integration in Africa is still at its infancy (Kaliisa & Michelle, 2019; Kaliisa et al., 2019). In Ghana, the University of Education, Winneba (UEW) is one of the universities that has been at the forefront of mobile learning initiatives. Mobile learning though, as technically distinguishable from e-learning, appears not to have been originally intended and as it is still not captured in any of the university’s policy documents, 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) platform. Formerly delivered only in its Distance programme to promote learning remotely, efforts are being made to scale up the mobile MOO-
DLE platform to the institutions’ regular programmes due to Covid-19; The stark reality of living through a pandemic during the COVID – 19 outbreak which resulted in a sudden unanticipated and unplanned adoption of e-learning approaches to teaching and learning by many institutions globally, further spurred the formalization of mobile technology use in UEW and this may continue even when the pandemic is over regardless of the challenges it poses to both lecturers and learners.

Thus, there is an urgent need for stakeholders especially in higher education institutions like UEW, to review the status of mobile learning to inform implementation and policy directions in ways that will improve teaching and learning as stipulated in national policies. Such reviews will provide significant and evidence-based information about the effective delivery of mobile learning, and the role of communities of practice in improving the quality of instruction in higher education institutions. In this regard, the study examines the status of mobile learning from the perspective of students in the UEW, an Institution perceived to be leading in the deployment of emerging technologies in teaching within the country. Though mobile learning is an area which is under-researched in this context, few studies have explored familiarity, particular features, user experience and potential instructional benefits (Amenyedzi & Badzongoly, 2018; Grimus & Ebner, 2014) of mobile device usage. Other studies (Edumadze et al., 2019; Tagoe & Abakah, 2014; Frimpong & Vaccari, 2015), though have explored mobile usage from the perspective of students, they have not focused on salient characteristics and facilitating conditions which are essential areas of investigation in this current study. The salient characteristics and the facilitating conditions of mobile learning combine to identify the mode of online delivery, confirm efforts put in by an institution to promote its use and also provide feedback on the quality of the end-users experience. Thus, alongside students’ experiences, this study examines the characteristics of mobile learning and facilitating conditions as it pertains to the UEW. Findings from this study will thus, add new insights to ones already gleaned from earlier studies on mobile learning.

2 Literature review

2.1 Potential benefits of mobile learning

Mobile learning is defined as “the use of mobile or wireless devices for the purpose of learning while on the move” (Vyas & Nirban, 2014, p.27). According to literature (Vyas & Nirban, 2014; Drigas & Pappas, 2015), the gadgets employed for mobile learning include smartphones, palmtops, cell phones, handheld computers-tablets, laptops, iPods and personal media players. 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). Similarly, it could be a potential alternative for instructional delivery across wider geographical locations without university infrastructural provision, thereby absorbing large numbers of potential applicants in third world countries (Kaliisa & Michelle, 2019; UNESCO, 2014). Literature (see Criollo-C et al., 2021; El-Sofany & El-Haggar, 2020; García-Martínez, Fernández-Batanero, Cobos Sanchiz & Luque de La Rosa
suggested that mobile learning is an effective way of increasing access, diversifying and improving instruction, enhancing learning and improving educational outcomes. According to several researchers (Al-Hunaiyyan, Alhajri & Al-Sharhan, 2018; Gambo & Shakir 2019; Onah et al., 2021), it has been shown to exhibit 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. 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). According to Mehdipour & Zerehkafi (2013), mobile learning affords access using sophisticated, portable, and capable gadgets at any location and at any time; it has advantages over other forms of web-based or Internet-based modes of instructional delivery which are accessible at a fixed location or from a gadget at a fixed location. With the ‘Digital Natives’, ‘Millennials’ or ‘Net Generation’, the use of mobile technology is a cultural issue, it is the norm (Ali, 2018). Ali noted that when there is increased access to internet learning and for that matter mobile learning, students’ intercultural skills are developed while promoting their global awareness as well. Gambo & Shakir (2019) argue that mobile learning provides a student-centred environment that facilitates retention. They reiterate that mobile learning offers students an environment that allows for a better understanding of educational content and thus has the potential to facilitate their adoption to solve novel problems in different contexts.

These potential benefits of mobile learning justify the ‘frantic’ efforts by educational authorities, especially universities in Ghana, to roll out web-based technology-enabled instructional delivery to produce graduates with 21st-century skills with global competitiveness (Ministry of Education, 2015). However, to ensure increased access and improve the quality of education delivery, mobile learning must be supported and characterized by a robust ICT environment.

### 2.2 Characteristics of mobile learning

According to literature, mobile learning has peculiar characteristics. Mehdipour & Zerehkafi (2013) distinguish mobile learning from e-learning based on six characteristics: - place, pedagogical change, instructor-student interaction, student-student interaction, feedback to students, assignments and tests, and presentations, exams and assignments. Kljunić & Vukovac (2015) extended these characteristics to 12 in their work among tertiary students in Croatia. These, in summarized form, include: **Place** –The ‘place’ characteristic suggests that mobile learning is neither fixed to the classroom nor follows structured time schedules. Laurillard & Pachler (2007) explain that digital support proposes a wide variety of environments even including remote locations in which both the teacher and learners can operate. **Ubiquity [Spontaneity]** - The characteristic suggests that learning is spontaneous since students can learn anywhere and anytime. According to Vosloo (2012), mobile learning makes it possible to learn from any location and at any given time using mobile technologies. Lan & Sie (2010) contend that mobile learning models and technologies allow access to learning materials irrespective of one’s location and time, provided there is internet access. **Portability**- Mobile learning devices are small and portable (Cavus &
Ibrahim, 2009), and thus can be carried anywhere and anytime. Accordingly, learners can use them everywhere for their learning activities. Instant Information Accessibility - Using a mobile device is characterized 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 requires quick feedback on specific questions (Cohen, 2010). 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 - One function of mobile devices is their 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. Blended Learning - This refers to a variety of approaches that appropriately combines virtual and physical learning resources to deliver instruction (Ally, 2009). Blended learning, which puts together face-to-face classroom instruction and m-learning, can maximize the benefits of both face-to-face and online methods (Al-Sharhan, 2018; Gambo & Shakir 2019; Onah et al., 2021). Communication and Interactivity - Mobile learning environments use available technologies to make instruction interactive (Cavus & Uzunboylu, 2009) and support students’ active participation in class and flexible, rich and spontaneous communication among teachers and students in and out of real-time (García-Martínez, Fernández-Batanero, Cobos Sanchiz & Luque de La Rosa, 2019). According to Sinha & Bagarukayo (2019), mobile apps allow for information sharing in the form of texts, videos, and audio files. These apps have the potential to greatly impact the quality of teaching and learning in resource-constrained learning environments, especially in developing countries. Collaboration - Mobile technologies enable cooperation and sharing of ideas among students and teachers. They are used for cooperative learning activities (Willemse et al., 2019) in education. According to Kafyulilo (2012), collaboration brings to light the quality of interaction among learners and also learners and instructors. Feedback to Students - Mobile devices and mobile education gadgets and software enables teachers to provide feedback to learners at any time and support their learning with different educational content beyond the classroom instructional period. The device allows feedback to be given on a one-on-one basis and done synchronously or asynchronously (Mehdipour & Zerehkafi, 2013). Assignment and Tests [Access] - With Internet access, tests and assignments can be taken anywhere at any location (Kljunčić & Vukovac, 2015); feedback is instant and adaptable to students’ specific needs (Mehdipour & Zerehkafi, 2013). Presentations, Exams and Assignments - According to Mehdipour & Zerehkafi (2013), presentations can be monitored from a remote location, assignments delivered at any place and time while examinations can practically be taken on site. Imazeki (2014) also indicated that when students use devices they own, the ease of use allows them to prepare for their learning and are able to answer quiz questions in the classroom.

The characterization of mobile learning by Kljunčić and Vukovac (2015) as discussed herein is not only comprehensive but also provides well-delineated criteria employable for examining the existence or assessment of the state or quality of mobile learning deployed by educational institutions.
3 Research questions and research design

A cross-sectional survey design was adopted to explore the experiences of students with mobile learning in UEW. The study’s focus, therefore, was to explore the state of mobile usage in learning from the perspective of students, describe students’ mobile learning experiences and identify the facilitating conditions for mobile learning available in the University. To address the overall goal of the study, the following specific research questions were addressed:

1. What do students perceive as characteristics of mobile learning in UEW?
2. What are students’ mobile learning experiences in UEW? and
3. What do students perceive as facilitating conditions for mobile learning in UEW?

4 Methods

4.1 Participants

The University has a main campus and 4 satellite campuses as well as 37 distance education centres with three categories of students: regular, distant, and sandwich spread across the centres. While the distance education students are non-regular and access education on weekends, the sandwich students access education when the regular students are on break for vacation. This study was carried out among distance education and sandwich students offering various Diplomas and Degree programmes. Data was collected through accidental sampling. In all, 250 questionnaires were administered to the respondents, however, 222 completed questionnaires were retrieved giving a response rate of 88.8%. A total of 138 students were distance learners while 84 were from the sandwich programme. The participants were made up of 123 males and 99 females aged between 25 and 55 with an average age of nearly 34 years.

4.2 Instrument

A questionnaire made up of four sections was employed during the data collection process of the study. The first section (Section A) sought respondents’ background information such as age, gender and experience of respondents. Section B had 39 items which addressed the question of how participants in the study characterized mobile learning. The items were based on the 12 characteristics outlined by Kljunić and Vukovac (2015). While place and ubiquity or spontaneity were proposed as separate characteristics by Kljunić and Vukovac, they were combined and presented as one characteristic feature in this study; the two constructs as described seemed to be interwoven. The characteristics were measured on a five-point Likert scale ranging from strongly agree (5) to strongly disagree (1). A mean score of 3.0 or above depicted a strong positive perception, while scores lower than 3.0 indicated weak perceptions of the respondents. Section C had 20 items on respondents’ access levels and their personal experiences in using mobile devices to learn. Respondents were required to indicate their access or level of experience from a given number of
Section D had 10 items on prevailing conditions in the institution that facilitate mobile learning. The conditions were measured on a 5-point Likert scale ranging from strongly agree (5) to strongly disagree (1). The face and content validity of the questionnaire was established through scrutiny by two experts who teach educational technology. The calculated Content Validity Index (overall) for the questionnaire was 0.76, indicating a high degree of content validity (Cohen et al., 2018).

### 4.3 Data collection and data analysis procedures

The questionnaire was distributed to the students across the different centres of the campus during their face-to-face sessions. The first author visited the various centres and gave the questionnaires to any student (either in the sandwich or distance programme) he met, who at the same time consented to participate in the study. Data were analyzed using descriptive statistics.

### 5 Results

#### 5.1 Characteristics of mobile learning

One important issue dealt with in addressing the question in this study was how participants in the study characterized mobile learning. Items used in determining respondents’ mobile characteristics were measured on a five-point Likert scale from strongly agree (5) to strongly disagree (1). Items under each characteristic were scaled to obtain the mean value to represent that characteristic. The characteristics were measured on a five-point Likert scale ranging from strongly agree (5) to strongly disagree (1). The output was interpreted as, a mean score of 3.0 or greater represented a strong positive perception, while scores lower than 3.0 depicted weak perceptions of the respondents. Table 1 displays the results of the analysis in descending order of magnitude of the means.

The results as shown in Table 1 depicts that characteristics of the mobile device that enable users to send and receive instant information (*Instant information accessibility* ($M=4.05, SD=1.01$)) was ranked the highest while the *Communication and Interactivity* ($M=4.04, SD=0.79$) was ranked second.

### Table 1 Characteristics of Mobile Learning ($n=222$)

| Characteristic                                 | Mean | SD  |
|------------------------------------------------|------|-----|
| Instant Information accessibility              | 4.05 | 1.01|
| Communication and Interactivity                | 4.04 | 0.79|
| Collaboration                                  | 3.75 | 0.69|
| Blend of Learning Styles                       | 3.75 | 1.23|
| Portability                                    | 3.61 | 0.79|
| Pedagogical Change                             | 3.52 | 0.45|
| Place and Spontaneity                          | 3.47 | 1.00|
| Feedback                                       | 3.39 | 0.66|
| Privacy                                        | 2.95 | 0.77|
| Access to Test and Assignment                  | 2.64 | 0.90|
| Remote Monitoring of Presentations, Assignments and Test | 2.53 | 1.03|

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interactivity (M=4.04; SD=0.79) characteristic which promotes students’ learning through active participation in a flexible, rich and spontaneous communication was ranked second. The characteristics of mobile learning that promoted Collaboration, Blend of Learning Styles, Portability, Pedagogical Change, Place and Ubiquity (Spontaneity) and Feedback to students were somehow/partly evident while Privacy, Access to Tests and Assignments, Monitoring of Presentations, Exams and Assignments were sparingly evident with the least (M=2.53, SD=1.03) reported in Remote Monitoring of Presentations, Assignments and Test. The dichotomous data in Fig. 1 further throws more light on Portability as a characteristic as reported by the respondents.

This characteristic was measured on a dichotomous scale: Yes or No. Results showed that respondents indicated fairly high responses on the portability of mobile devices for learning; 216 respondents (representing 97.3%) indicated yes for the item “the mobile device I use to access learning/courses can be carried on me (or is with me wherever I go)” and 161 respondents (representing 72.5%) indicated yes for the item “the mobile device I use to access learning/courses is less than 1 kilogram”. Furthermore, an overwhelming number (213 representing 95.9%) indicated owning the devices. A similar analysis was conducted to ascertain the extent of the methods adopted for mobile learning as described in the pedagogical change characteristic. The results showed the use of a variety of pedagogical modes including instruction in texts, pictures, voice, video and animations evident in respondents’ mobile learning environment. Figure 2 indicates that respondents use more of a combination of the modes in learning when using their devices than just focusing on only a mode or two.
5.2 Respondents’ access levels and experiences with mobile devices for learning

Exploring the different devices used for learning among the respondents, the analyses revealed that tablet was the most (102 representing 45.9%) common device used among the respondents followed by the smartphone (89 representing 40.1%). The least (4 representing 1.9%) was reported on the use of computers (see Table 2). The study (see Table 2) further revealed that while a good number (49.5%) of respondents indicated their preference for using laptops for learning, a whopping majority (191 representing 86%) of them actually use mobile devices (smartphones and tablets) for their learning. With regards to the cost of their preferred mobile devices, 83.8% of respondents indicated prices below GHC 500.00 (about 73.5 Dollars) which seems to explain why an overwhelming number of 213 (about 95.9%) reported that they own the mobile devices they use in learning or accessing their courses (see Fig. 1).

On how respondents acquired their mobile devices for learning, 56.3% of respondents indicated buying the devices themselves; 34.7% paid for them and had the devices supplied by the institution, 7.7% received them as gifts from friends and 1.4% were supplied free of charge to them by the institution. The question on how respondents learnt to use mobile devices to learn or access course content was also explored. The result shows that majority (58.1%) of the respondents were introduced to learning via mobile device in the university; 30.2% by friends; 45% at their workplaces; 3.6% at their pre-tertiary institutions and 3.6% from other sources. The findings further suggest that respondents use mobile devices that are capable of accessing content from the Internet; 93.2% of respondents indicated this. Responding to the question as to whether they use their devices to surf the Internet, 95.5% responded in the affirmative while 4.5% declined. The result further showed that 46.8% of the respondents have practised this for 1–2 years, 26.6% for 2–3 years, 12.6% for 4 years
...and above and 11.7% for less than one year. Thus, 73.4% have used their mobile devices to access learning between one and three years. In response to how students obtained internet connection data to access learning, 47.3% responded that they use their own purchased data while 52.7% indicated they use the university’s internet service.

The kind of activities in which respondents engaged in when using their mobile devices for mobile learning were also reported. The results showed high rating in surfing the Internet for general information (52.3%) followed by contacting friends and lecturers on academic issues (26.6%). Taking quizzes and exams (11.3%) was the next ranked and the least was using the devices in completing assignments (3.6%).
Respondents also shared their experiences regarding whether or not they use their devices to access resources or courses from the Institutions’ Learning Management System (LMS). As mentioned earlier on, the Institution had deployed MOODLE -LMS for over a decade and although management had encouraged lectures to make use of the system with their students, the state and extent of use had not been explored. Table 3 presents the respondents’ experiences with the LMS and the extent to which respondents could access content on the system. An overwhelming 90.5% of the respondents indicated that they do not take any course or access content on the university learning management system platform. As a matter of fact, 78.4% of the respondents disagreed that the university provides courses which they could access online; an indication that a good number of the students did not know about the existence of the LMS. Of the number (21) who take courses/content online, 15 (representing 71.4%) use their mobile devices to access them on the LMS. This seems to suggest that only a small number (28.6%) of respondents who use the LMS actually access content using the computers in the institution while on campus. On how they access their courses in general, about 90.1% of the respondents indicated making use of printed coursebooks, 6.7% used the university online learning management system platform and 3.2% used home or school computers. This means that learning from printed textbooks seems to be the most dominant mode of students’ learning.

### Table 3 Academic Activities Using Mobile Learning

| Statement                                                                 | Response                        | Freq. | Percent |
|--------------------------------------------------------------------------|---------------------------------|-------|---------|
| What academic activities do you use your mobile device for?              | Surfing the Internet for general information | 116   | 52.3    |
|                                                                          | Learning my course content       | 25    | 11.3    |
|                                                                          | Completing assignments           | 8     | 3.6     |
|                                                                          | Taking quizzes/exams             | 14    | 6.3     |
|                                                                          | Contacting my friends/lecturer   | 59    | 26.6    |
| Do you currently access or take any course partly or fully online?       | YES                             | 21    | 9.5     |
|                                                                          | NO                              | 201   | 90.5    |
| I use my mobile device to access courses on my university’s learning platform | YES                             | 15    | 6.8     |
|                                                                          | NO                              | 207   | 93.2    |
| The university provides courses which we access using mobile devices    | YES                             | 48    | 21.6    |
|                                                                          | NO                              | 174   | 78.4    |
| How do you access your courses?                                          | University online platform      | 15    | 6.7     |
|                                                                          | Home/Univ. computers             | 7     | 3.2     |
|                                                                          | Printed Course Book              | 200   | 90.1    |

5.3 Perceived facilitating conditions for mobile learning

Prevailing conditions in the institution that facilitate mobile learning were also explored. The conditions were measured on a 5-point Likert scale ranging from strongly agree (5) to strongly disagree (1). Table 4 displays the perceived facilitating conditions of respondents for mobile learning. The study points to favourable responses to facilitating conditions that ensure easy access to mobile devices as well as quick access to internet from respondents’ mobile devices. Furthermore, time and
one’s location have been reported as no hindrances to access. Thus, out of the ten survey items on facilitation conditions, four items: [University facilitation of access to mobile device], [Access to courses using device], [Easy access to Internet using device] and [Speed of Internet that enables access and download/upload of information when required] that respondents agreed were available facilitating conditions for mobile learning in the institution.

Facilitating conditions in the form of technical support or tutorials that could help students’ access to content and promote effective use of the LMS were limited. These were reported in the rest of the 6 items that include: [Provision of tutorials on how to access online learning], [The ease of navigating the online learning platform, LMS], [Access to technical support on the learning platform LMS], [Provision of 24 h support in cases of interference in access], [Availability of experts to work on devices for accessing learning] and [Availability of constant uninterrupted access to courses]. There may be a need for the institution to put in measures to provide support to students in this regard.

### 6 Discussion

The study examined the status of mobile usage and available facilitating conditions that influence mobile learning among higher education students in the UEW, an Institution perceived to be leading in the deployment of emerging technologies in teaching within Ghana. In the study, data were collected from some distance and sandwich students from the Institution with the goal to gain an understanding of what they perceive as characteristics of mobile learning, describe their mobile learning experiences and identify the available facilitating conditions for mobile learning.

The characteristics of the mobile learning were reported based on indicators outlined by Kljunić and Vukovac (2015). While respondents reported overall high values depicting positive perceptions of most of the 11 characteristics measured in the current study (See Table 1), it was found that the Instant information accessibil-
ity and communication and interactivity characteristics were the two highly ranked as also found in Kafyulilo (2012), a study conducted among higher education students in Tanzania. Collaboration, Blend of Learning Styles and Portability were also ranked high, while Pedagogical Change, Place and Spontaneity and Feedback were positively ranked. Thus, from the findings, the authors advocate that mobile devices appear to be more convenient for learning than any of the technological tools reported in this study in terms of instant information accessibility-sending or receiving of information in real-time (cf. Gambo & Shakir, 2019; Onah et al., 2021); communication and interactivity –supporting learners’ active participation and spontaneous communication (cf. Cavus & Uzunboylu, 2009); enhancing blended learning –maximizing the benefits of both face-to-face and online methods (cf. Gambo & Shakir 2019; Onah et al., 2021) and promoting collaboration – cooperation and sharing of ideas among learners (cf. Willemse et al., 2019). While participants reported further that mobile learning devices themselves are portable–handy (cf. Kafyulilo, 2012); promote feedback to learners at any time (cf. Sinha & Bagarukayo, 2019) and allow for easy pedagogical change – promoting varying learning methods (Mehdipour & Zerehkafi, 2013), response on the ‘Place and Spontaneity’ characteristic indicated that using mobile learning devices make it possible to learn from any location at any time (Lan & Sie, 2010). These potential benefits of mobile learning as reported by the participants of this study provide enough grounds to believe that, if well planned and properly integrated, the use of mobile learning devices in the Institution are likely to provide learners with a wide range of flexibility which in turn will lead to better learning outcomes (cf. Kafyulilo, 2012).

Another important issue dealt with in addressing the question in this study was students’ mobile learning experiences at UEW. The respondents’ self-reported data showed that even though majority (about 50%) of the students affirmed they prefer to use laptops to learn, about 86% reported using mobile devices (tablets and smartphones) to learn in practice, while only 6.8% indicated the use of laptops. Majority (about 56.3%) of the respondents bought their own mobile devices, but a good number (34.7%) acquired them through arrangements of the Institution; the Institution in collaboration with some mobile companies had put in place a mechanism (namely, Pay-And-You-Are-Supplied-A-Device -PAYASAD) to provide students with mobile devices with flexible payments schemes. The study, therefore, revealed that given the prices of phones students patronized, they could afford relatively cheaper mobile devices. The finding is an interesting one that seems to suggest that perhaps, because of the relatively high cost of laptops, students will rather choose to use mobile phone devices which would serve the same purpose in any case as laptops.

Again, the finding that the majority of respondents possess and use mobile devices to access for various purposes confirms Frimpong & Vaccari (2015) assertion that access levels and use of mobile devices of Ghanaian students are high. In addition, the finding that majority of students possessed devices that were mobile-learning compliant with internet functionality and capable of accessing data in various media (see Table 4) is worth mentioning. This showed a strong indication that students were ready to make good use of their devices to access digital learning materials for learning. These findings establish an important first step in driving the University of Education’s initiatives to deliver quality education by increasing access to students
in remote areas of the country. Thus, the authors reiterate that device ownership or access is critical and its use to access learning is a primary requirement for mobile learning and as reported by literature (Drigas & Pappas, 2015; Kafyulilo, 2012; Yusuf & Al-Banawi, 2013); lack of access to mobile devices would be a major setback to any mobile learning initiative. Consequently, we argue that high access levels to mobile devices will increase the Institution’s potential to make its programmes available and flexible to learners across wider geographical locations in the country and beyond even when the university’s infrastructural provisions were limited (cf. UNESCO, 2014). While mobile learning is touted as cheaper, the cost implications could make device acquisition and usage inhibiting to students in the long term (Yusuf & Al-Banawi, 2013). The Bring-Your-Own Device (BYOD) strategy in which learners make use of their personally owned devices to access digital content seems to be working quite well in the institution; however, the PAYASAD policy of the University may still be relevant to ensure that students (especially those who cannot afford to buy) are given flexible payment terms to own mobile devices to be able to access learning.

The study has also revealed that students use their own data, but this was supplemented by the University. In the context, internet was accessed through two different means; the institution-wide Wi-Fi and data bundle purchased by students themselves. The implication is that students incur further costs in purchasing internet bundle data. The authors advocate that the University may have to expand its Wifi so students would not have to bear the cost of buying data for access. Access to internet is crucial in the modern approach to information transmission and as reported by Arthur-Nyarko et al. (2020), one of the clear ways to ensure sustainable access to internet through mobile learning technologies in the context is for the Institution to provide unlimited internet connectivity.

The difficulties in accessing internet notwithstanding, it would be expected that the Institution should have made some considerable provisions in deploying web-based technology-enabled instructional delivery owing to the fact that majority of the participant were reported to possess and use mobile devices. Nevertheless, this attainment is yet to be met as our results posed an interesting challenge to the acceptance and use of mobile devices for learning purposes. These arguments were echoed in the responses of the participants which showed that regardless of their affection for surfing the internet for general information, their use of mobile devices to access academic activities which involves learning course content, completing assignment and taking quizzes/exams (see Table 3) was low. An overwhelming 93.2% of the participants indicated that they did not use mobile devices to take any course or access content on the University LMS platform. As a matter of fact, majority of the participants reiterated that the University does not run courses online that necessitate the use of mobile devices in accessing them – an indication that the University’s instructors did not use the Institutions’ LMS with their students inspite of management quest to promote its use. Apparently, limited knowledge of the use of the technological tools including the LMS and mobile devices to support teaching could have accounted for this. Sa’ari et al., (2005) have shown that if teachers are to use technological tools in their teaching, they must consider themselves qualified to teach with them and be comfortable using them. This result speaks to the need for organizing professional
development programs for the University’s instructors and students alike in order to develop their understanding of how mobile devices can be integrated into the teaching and learning process effectively.

Results of the study also showed that facilitating conditions for mobile learning subsumed in the availability of mobile learning infrastructure seem prominent in UEW; while those relating to the provision of technical and administrative support were lacking (see Table 4). Thus, the findings show that respondents’ perceived device access and/or ownership, usage, and access to Internet (basic ICT infrastructure) were available facilitating conditions in the University while administrative and technical support conditions that are critical for mobile learning instructional delivery were lacking. These available facilitating conditions could set the tone; providing the yardstick for effective implementation of mobile-enabled learning environment in UEW. However, a suggestion that much remains to be done to make mobile learning both accessible and beneficial at UEW will be the provision of administrative and technical support; Alhajri (2016) cites technical and administrative support as critical for the effective and efficient delivery of mobile learning. In this context, the technical and administrative support were mainly connected to the deployment of the Institution’s LMS as reported in Table 4. As reported, majority of the students seem not to be aware of the existence of an online LMS in the University even though there was a link to it on the University’s official website. Thus, despite the fact that students showed positive experiences with mobile devices and used them in accessing learning through engagement in different academic activities these were largely not via the University’s LMS. It appears that even with the challenges of COVID-19 in recent times, both students and their instructors have been comfortable with the use of social media such as WhatsApp and Telegram in exchanging information and messages and video conferencing tools such as ZOOM and Google Classroom and not so much of the LMS.

7 Conclusions, implications, research limitations, and future work

The study had some limitations. The use of accidental sampling and the collection of data from a specific university with its unique context precludes a broader generalization of its findings. Consequently, the sampling strategy employed, in addition to the relatively small sample size compared to the total student population, does not lead to using standard tests of statistical inferences that can be used to draw conclusions about the target population. Future studies into exploring the state of mobile learning from students’ and instructors’ perspectives across different higher institutions in the country would provide better insight into the problem under investigation. The limitations of the study notwithstanding, the findings infer implications for practice in the setting of the study. Insights into mobile devices that can be employed for instructional delivery in other institutions with similar contexts that are seeking to implement or scale up mobile learning can also be inferred.

The results showed high access levels of personal mobile devices are owned by students. However, some students faced some difficulties in acquiring their devices; an indication that access problems may continue to exist in the future. We advocate
that in the interim, while UEW takes advantage of the access levels and operates the policy on Bring-Your-Own Device (BYOD) (cf. Arthur-Nyarko et al., 2020), the University’s policy of supplying tablets to students at affordable prices may have to continue to allow students who cannot purchase mobile devices do so at flexible conditions.

The study also showed that students have positive experiences with mobile devices and use them in accessing learning somehow through surfing the internet for general information, but largely not via the University’s Learning Management System (MOODLE). There is a need for a complementary implementation drive to get students informed about available ICT resources, provide them introductory tutorials on the use of ICT resources and enrol them to take a number of online courses. Enrolling students on the platform should be a whole university-wide or systemic programme and should not be left in the hands of individual students to decide whether or not they will migrate to the platform. Training of the Institution’s instructors to equip them with ICT skills to be able to mount courses, run and manage them on the LMS also become imperative. According to Bansah & Agyei (2022) and Agyei (2021), when instructors are provided with such training support, they can handle the realities of teaching with ICT; newly appointed instructors are also supported from abandoning innovative teaching approaches with ICT in favour of what they may perceive as safer and less complex activities.

The study has also shown that mobile learning exists in a somewhat structured form but is not fully harnessed in the University; it seems an unintended consequence of the attempt to provide e-learning (the parent ICT learning mode to mobile learning). There is a need for the University’s official adoption and formulation of policy on mobile learning to guide implementation and unearth its full educational benefits. As evident, there is a need for a policy to drive the system to make it a fully compliant mobile learning educational environment. When such a policy is clearly articulated within the framework of the Institution, it will help in providing a firm foundation in teaching and learning with mobile devices to improve learning outcomes (Bansah & Agyei, 2022).

We believe the implementation of these recommendations will not only firmly establish the University of Education as a forerunner in the integration of mobile devices in education delivery but also expand its capacity to increase access to education and improve the teaching and learning experiences of the lecturers and students respectively not only in the COVID–19 pandemic era, but more so when the pandemic is over.

Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest None.
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