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## INFORMATION & COMMUNICATIONS TECHNOLOGY IN EDUCATION | RESEARCH ARTICLE

# Electronic learning among students at public universities in Ghana

Dominic Afful<sup>1</sup> and John Kwame Boateng<sup>2\*</sup>

**Abstract:** This study was planned to establish the extent of the usage and benefits of mobile technologies to learn by distance learners at the University of Ghana and the University of Education, Winneba. The study adopted an explanatory sequential mixed-method design. Structured questionnaires were administered to 400 distance learners selected by multi-stage sampling technique and phone interviews involving 20 participants selected by random sampling technique to collect data. Using the Relative Important Index and Thematic analysis, the findings show that respondents not only agreed to all the mobile learning academic activities and benefits raised in this study as relevant but fundamental to their studies. The five most important mobile learning activities by students are communicating with colleagues for information, participating in online courses, doing coursework assignments, holding meetings among colleagues and instructors, and forming networks with peers on a social media platform. The highest of the first five highest-ranked benefits is finding relevant material for coursework with ease, studying at own pace in different environments, learning anywhere and anytime, receiving real-time information, and having quick access to coursework content. The findings of this study can encourage institutions offering distance education to build strategic electronic learning implementation plans and design guidelines by taking into consideration the highest-ranked important benefits and uses of mobile learning identified in this study.

**Subjects:** Communication Technology; Management of IT; Study Skills; Theories of Learning; Adult Education and Lifelong Learning; Continuing Professional Development; Educational Research; Higher Education; Inclusion and Special Educational Needs

### ABOUT THE AUTHORS

Dominic Afful holds a PhD from the Department of Adult Education and Human Resource Studies of the University of Ghana. His research interests cover remote education and mobile learning. He studied educational technology and public transportation. His focus has been on the integration of mobile learning into pedagogy and the challenges, benefits, and impacts of emerging technologies on the mass education of African Youth.

John Kwame Boateng holds a PhD from Pennsylvania State University (PSU), USA. He is an Associate Professor at the Department of Adult Education and Human Resource Studies. His research interests cover remote education, learning management systems, ICT, emerging and mobile technologies integration into curriculum and pedagogical development, and the role of such technologies in mass education of the African Youth. He is excited to continue to work towards supporting students' innovativeness, peer networks, and self-efficacy, through future research and advocacy.



**Keywords: Electronic learning; mobile learning; distance education; digital devices; student learning; technology**

## 1. Introduction

Electronic learning also known as E-learning is the use of a variety of communication technologies such as multimedia technologies, computers, computer-enhanced learning applications, and the Internet to access educational programme AlRawashdeh et al. (2021). E-learning provides a positive learning environment where studying activities take place outside of traditional or formal educational settings on a self-directed basis with personal developmental objectives Myers et al. (). The multimedia resources of e-learning technologies offer text, audio, and video, which enable individual students to learn through diverse methods in the global arena. The focus of this study was on mobile electronic learning devices used by students in accessing educational information. Mobile learning is a sort of e-learning that uses mobile devices, the internet, and wireless transmission. Mehdipour and Hamideh () explained that electronic learning is a fixed-wired digital learning method while mobile learning is a mobile-wireless learning method, and Podlacha et al. () confirmed that electronic learning is a broader concept consisting of mobile learning and online environments which suggests that mobile learning is a subset of electronic learning. According to Korucu and Alkan (2011), e-learning is interactive and employs computers, bandwidth, and multimedia, whereas mobile learning is spontaneous and uses mobile phones, GPRS, G3, G4, and Bluetooth. Suartama et al. (2014) argued that e-learning involves learning at the right time but learners cannot get information immediately all the time and learners' interaction is limited but mobile learning enables students to learn at the right place and time where they get information immediately from peers and instructors in varied environments with a specified mobile device

A foundation for expanding access, flexibility, quality, and equity to higher education is provided through distance learning, regardless of where a person lives (Mends-Brew & Asabere,). Distance learning has increased since the turn of the 20<sup>th</sup> century because of technological advances (Schultze, 2004). Due to the development and expansion of mobile cellular subscriptions, mobile learning has superseded electronic learning in distance education, which is learning reinforced by digital devices and media. Mobile learning is the term for electronic education that makes use of wireless transmission and portable equipment or technology (Crompton, 2013).. In 2021, 83 percent of people had access to mobile broadband, and there were 110 mobile cellular users for every 100 persons worldwide (ITU, 2021). In Ghana, the fourth quarter of 2020 had a penetration rate for mobile voice subscriptions of 130.85%, with 40.46 million subscribers. A penetration rate of 85.60 percent per 100 people was achieved in the same period with 26.47 million mobile data subscribers. 2021 will see the National Communications Authority. Mends-Brew and Asabere () predicted that the primary method of teaching and learning in distance education in Ghana will be mobile learning. In accordance with the research by Tagoe and Abakah (2014), 98.7% of University of Ghana distance education students owned cell phones and around 73.1 percent of those students expected to include mobile learning in their program. The University of Ghana and the University of Education, Winneba, have developed integrated mobile learning platforms and programs to enhance the effective use of mobile learning technologies for teaching and learning. The Sakai and Moodle learning management systems, respectively, are used by the UG and UEW distance learners to access course materials, conduct exams, complete assignments, take quizzes, and communicate with teachers and other students.

Gatotoh et al. (2018), however, believed that the success of mobile learning in the context of distance education is not dependent on the effectiveness of the learning management systems and mobile technologies alone, but the factors that influence students' adoption or usage of mobile learning. Determining and understanding the factors influencing distance learners' current use of mobile learning is crucial for the deployment of mobile learning to be successful. Cavus and Al-Momani (2011), Crompton (2013), and Kankam and Wang (2020

Johnson et al. () explained that mobile learning applications help distance learners in institutions of higher education accomplish a degree with high precision and efficiency. Tagoe and Abakah (2014) found out that the use of mobile technologies makes learning easy for 400 distance learners at the University of Ghana. These students copied timetables and other documents with their mobile phones and used them on social networks. According to Cavus (2011), the mobility feature allows students to assess learning resources at any time and from any location and the portability feature allows students to carry their learning anywhere with less difficulty (Crompton, 2013). The flexibility of mobile learning allows students the freedom to study at their own pace and time (Cavus & Al-Momani, 2011), and mobile learning enhances activities that promote cooperative learning and knowledge sharing among students and instructors through social media due to its interactive features (Al-Emran et al., 2016). According to Leung and Cheng (), multimedia technologies enable real-time social networking, mobile search, and capturing of images from both offline and online for learning.

In general, literature has shown indications of how mobile learning activities and benefits facilitate students' learning. For instance, writers have shown that the features of mobile learning technologies make learning easy, simple, and effective at any place and at any time. Literature has also presented the use of mobile learning technologies for various learning activities such as administering quizzes and surveys (Hindy, 2020), participating in virtual classes, and acquiring study materials (Mehdipour & Hamideh), sharing learning content among students and teachers, and holding of meetings (Hockly, ; Kukulska-Hulme et al., 2011).

Conversely, the literature has not assessed the extent to which mobile learning activities and benefits affect students' actual mobile learning usage. Moreover, there is little or no information about which type of mobile learning academic undertakings and benefits are most relevant and vital to students' mobile learning usage. All the forty-five empirical studies including the only three studies conducted in Ghana by Kankam and Wang (2011), Buabeng-Andoh (2018), and Tagoe and Abakah (2014) on factors that influence mobile learning intentions and adoption identified by this study could not examine the significance of mobile learning activities and benefits on students' mobile learning usage.

This study first used the Relative Importance Index to examine the impact of mobile learning usage benefits and activities on the students' current mobile learning usage. It was followed by exploring the students' opinions of the first five highest-ranked activities and benefits. The aim was to ascertain the learning activities and the benefits the students consider relevant to their studies. The findings could guide distance education institutions in designing appropriate mobile learning platforms by taking into consideration the degree mobile learning activities and benefits impact students' learning. The mixed method used permitted a detailed understanding of the usage and benefits of mobile learning by distance learners.

## 2. Overview of distance education

The current innovations in learning technologies and the interactive nature of the internet assist the development of distance education to accomplish its aims. Education is now available in remote areas due to the use of mobile devices such as tablets, phones, and PDAs, as well as diverse media such as television, audio devices, and the internet, as well as learning software (Mostafa & Zafari, 2014). Technology has aided the growth of distance learning since its inception. Authors, including Taylor and Todd () and Schultze (2004) provide examples of how technology has evolved and influenced remote learning. Correspondence education, also known as home study or independent study, began in the 18th century as a program supported by print media, postal facilities, and train systems.

The second wave of distance learning concentrated on the use of broadcast media such as television and radio, however interaction between students and instructors was still limited (Bozkurt, 2019). The adoption of telecommunications capabilities that enabled computer-

mediated synchronous and asynchronous learning, which offered substantial involvement, drove the third generation of the twentieth century (M. Anderson & Simpson, 2012). Improvements in distance learning have occurred in the twenty-first century, or the fourth generation of distance learning. Learning models give priority to online or digital learning. Asynchronous and synchronous communication between instructors and students is made possible by digital learning (Sadeghi, 2019). Mobile learning must be included in contemporary distance education (DE) to enhance asynchronous and synchronous interactions between instructors, students, and peers (T. Anderson & Dron, 2011; Schultze, 2004).

### 3. Mobile learning

Scholars have categorized mobile learning based on the features of mobile learning tools, while others centered their descriptions on the advantages and goals of mobile learning. According to Sharma et al. (), mobile learning is a type of electronic learning that uses wireless transmission and portable devices. Mobile learning, according to Kothamasu (2010) is simply any type of learning that involves the use of mobile devices. In a more intricate way, Wong et al. (2015) defined m-learning as the use of ubiquitous hand-held devices together with wireless networks to facilitate teaching and learning. Kukulska-Hulme et al. (2011) stressed that m-learning is the use of mobile applications for distance education, and according to Parsons (2014), mobile learning is an extension of distance learning taking place in either formal or informal environments. Ozdamli and Cavus (2011) described mobile learning to consist of five basic elements: the learner, teacher, environment, content, and assessment.

Mobile learning devices include smartphones, PDAs, PCs, iPods, MP4 and MP3 players, Notebook computers, laptops, digital cameras, and gaming consoles (Hockly,). The most well-liked mobile learning apps for information exchange are Bluetooth, email, and Xender. WI-FI capabilities also allow students to have access to the internet. There are also Microsoft Word, Excel, PowerPoint, PDF Reader, and Adobe Acrobat for capturing, processing, and saving data. High-speed data transmission rates are provided by technical and delivery resources like GPRS, and collaborative platforms like Zoom, Skype, WeChat, and WhatsApp allow for live video and audio communication and content sharing.

The primary features of mobile devices are connectivity, interaction, portability, adaptability, and mobility (Kothamasu, 2010). Mobile devices are compact and portable, so it is easier for students to carry their learning wherever they go (Crompton, 2013). The flexibility of mobile learning gives students the opportunity to study whenever and wherever they choose, at their own pace (Cavus & Al-Momani, 2011). Mobile technologies' adaptable qualities make it possible for students to learn at their own pace and on their own schedules, which supports self-directed learning (Donham, 2010). When students use mobile devices to offer a reaction to a challenge (stimulus), behavioral learning occurs. Cognitive learning arises when the multimedia features of mobile technologies provide animations, images, video, audio, MMS, SMS, podcasting, and e-mails to facilitate the acquisition, processing, and delivery of information for learning (Keskin & Metcalf, 2011). Panda (2011) asserts that the usage of mobile networks and telecommunications can improve informal learning. Situated learning occurs when digital devices and learning environments such as Learning Management Systems offer the necessary context for distance learning students to conveniently use to acquire appropriate knowledge anywhere at any time (Wong et al., 2015).

### 4. Mobile learning in distance education

Mobile learning has been heavily integrated into distance education in recent years due to the growing prevalence of mobile-cellular subscriptions and the positive affordances supplied by the features of mobile learning technology. Ghana's mobile voice and data rates in 2020 were 131 percent and 86 percent, respectively (National Communications Authority), with 40 million consumers (2021). The mobility, portability, interaction, and flexibility features of mobile learning devices increase accessibility, quality, equality, and flexibility in distance education (Al-Emran et al., 2016). Díez-Echavarría et al. (2018) stressed that mobile learning should be made

mandatory in all distance education institutions due to the critical role it plays in the delivery of distance education. Experts from institutions offering distance education programmes throughout the world claim that mobile learning is frequently employed to promote distance education. Forty-six experts confirmed that mobile learning could support the expansion of distance education in Sudan (Al Hassan, 2015). Eltaveb and Hegazi (2014) established that 85% of Sudanese university students considered the use of mobile learning software to be a positive experience. Distance learners in Asia and the Gulf region adopted mobile learning. Distance learners at Thai universities had a high preference for mobile learning (Jairak et al., 2009). Also, 99 percent of 437 distant learners from Oman and the UAE used cell phones for learning (Al-Emran et al., 2016). Students in Ghana who are enrolled in distance education programs have shown themselves to be quite ready to adopt mobile learning. In a study of 400 distance learners at the University of Ghana, 98.7% of them had smartphones, and 73.1% of them intended to use mobile learning (Tagoe & Abakah, 2014). The University of Ghana's sandwich program's distance learners were enthusiastic about embracing mobile learning (Kankam & Wang, 2011).

## 5. Theoretical framework

### 5.1. *The transactional distance theory*

The Transactional Distance Theory propounds that there are three interconnected components governing and managing transactional distance education namely, the programme's organization, the communication between the teacher and the students, and the learners' independence (Moore, 2007). The analysis of the three factors determines the degree of teacher-student interaction and the determination of what, how much, and how students learn. Grounded in this theory, Park (2011) created a conceptual learning system based on individual versus socialized activity and high versus low transactional distance. The four types of distance learning are therefore categorized as Socialized learning with a high transactional distance, Individualized learning with a high transactional distance, Socialized learning with a low transactional distance, and Individualized learning with a low transactional distance.

Mobile learning usage is best typified by the Transactional Distance Theory. Leveraging on the crucial contribution to the framework by Park (2011) can create a total of four types of mobile learning usage in the context of distance learning at UG and UEW. The four forms of mobile learning usage can be distinguished as follows:

### 5.2. *Socialized mobile learning with a high transactional distance*

In this kind of mobile learning activity, students work in groups on projects where they can interact, negotiate, and collaborate while also having more psychological and communicative space with the teacher or institutional assistance. Transactions primarily take place amongst students, with the instructor playing a minor role in guiding the group activity.

### 5.3. *Individualized mobile learning with a high transactional distance*

Individual learners have a greater psychological and communicative room with the teacher or instructional support in this sort of mobile learning usage. Individual students use mobile devices to access highly structured and ordered content and resources such as lectures and readings that have been recorded. Individuals enrolled in distance learning are provided with downloadable resources such as texts, audio or video lectures, presentation slideshows, and opportunities to engage in online conversation as part of the distance education curriculum.

### 5.4. *Socialized mobile learning with a low transactional distance*

This type of mobile learning usage connotes a less loosely structured training provided to students having less psychological and communication space with the tutor. Students collaborate in groups to solve the given challenge, attempt to reach a common objective, and naturally participate in social interaction, negotiation, and regular communication using mobile technologies. This flexible

learning fits into each individual learner's busy schedule regarding when and where to study but is primarily influenced by the context of learning.

### **5.5. Individualized mobile learning with low transactional distance**

The learning content is ill-defined and loosely structured, and there is less psychological and communication space between the teacher and the student. The instructor can communicate directly with each individual learner, and she or he guides and manages the class to satisfy their requirements while preserving their autonomy.

## **6. Objectives of the study**

- (1) examine how distance education students' mobile learning activities influence their learning.
- (2) examine how mobile learning benefits affect distance education students' learning.
- (3) explore distance education students' opinions on the effect of students' mobile learning usage on their learning.

## **7. Methods**

The philosophical premise of the study was contextualized within the pragmatic paradigm. Consistent with the pragmatic paradigm, the mixed-methods approach was adopted for the study by coupling quantitative and qualitative approaches. It employed an explanatory sequential mixed-method design, which incorporates qualitative data to clarify quantitative data results. The Study population is 38,364 distance learners comprising 11,550 distance learners from the ten learning centers of the University of Ghana and 26,814 distance education learners from the thirty-five learning centers of the University of Education, Winneba across twelve Regions of Ghana. The target population comprised distance education students who had previously used mobile learning for at least one semester and those who were currently using mobile learning. Students who did not satisfy this criterion were excluded. The accessible population was made up of students who were available and willing to participate at the time of the research. A total sample of 400 students was selected using the method of determination of sample size by Krejcie and Morgan (1970). 120 from UG and 280 from UEW. The survey instrument constituted 11 items of mobile learning activities and 8 items of mobile learning benefits. The interview guide was designed to find out the students' opinions about the first five highest-ranked benefits of using mobile learning and how students use mobile learning technologies for their learning activities.

## **8. Results and analysis**

### **8.1. Quantitative**

Assessing mobile learning activities, the survey instrument comprises of 11-items. Respondents assessed all the issues offered in the survey on a scale of low (1) strongly disagree to high (5) strongly agree. The mean response values by students on the mobile learning activities items listed in Table 1 range from 2.873 to 4.323. The lowest mean response value is above the acceptable region. This means that most DE students agreed to use mobile devices to conduct all the learning activities outlined in this research.

Table 2 presents the RII for the learning activities respondents associate with mobile learning usage. It is shown that the first six levels of RII values are high (0.8 and above), which indicates that the important reasons for how students use mobile learning were ranked highly. The highest ranking for this assessment is to communicate with colleagues for information, with an overall ranking of 0.865. The second ranking was participation in online courses (0.845). The third ranking is for doing coursework assignments (0.833). The following were the holding of meetings among colleagues and instructors (0.828), formation of networks with peers on a social media platform (0.807), and engagement in course group discussions (0.800). It can be concluded that all the activities stated in this study are significant for the

**Table 1. Distributive statistics of mobile learning activities**

Mobile learning activities	Mean	Std. Deviation
To communicate with colleagues for information	4.323	0.756
To Participate in online courses	4.223	0.866
To do coursework assignments	4.163	0.835
To hold meetings among colleagues and instructors.	4.142	0.842
To form networks with peers on a social media platform	4.036	0.958
To engage in course group discussions	4.000	0.959
To listen to voice records in class.	3.784	1.209
To do course presentations	3.751	1.071
To participate in evaluating activities (quizzes and surveys).	3.749	1.170
To conduct examinations	3.470	1.195
To take videos and pictures in class.	2.873	1.357

**Table 2. Relative importance index of mobile learning activities**

Mobile learning activities	RII	Rank
To communicate with colleagues for information	0.865	1
To Participate in online courses	0.845	2
To do coursework assignments	0.833	3
To hold meetings among colleagues and instructors.	0.828	4
To form networks with peers on a social media platform	0.807	5
To engage in course group discussions	0.800	6
To listen to voice records in class.	0.757	7
To do course presentations	0.750	8
To participate in evaluating activities (quizzes and surveys).	0.750	9
To conduct examinations	0.694	10
To take videos and pictures in courses.	0.575	11

Source: Field survey 2021.

students' present mobile learning. Even, the lowest criteria rank under mobile learning usage activities, with the lowest ranking of 0.575, falls within the medium level of importance (0.500).

Regarding the benefits of including mobile learning in public distance education teaching and learning in Ghana, the survey instrument comprises of 8-items. Respondents assessed all the issues offered in the survey on a scale of low (1) strongly disagree to high (5) strongly agree. It is determined from the mean values that all students associate with all the benefits of using mobile devices for learning activities listed in Table 3. All the mean values are greater than 2.5 indicating that most respondents agree with all the issues raised about the benefits. All issues about the benefits of using mobile devices for academic activities have fallen under the high-

**Table 3. Distributive statistics of mobile learning benefits**

Benefits	Mean	Std. Deviation
My mobile device makes finding relevant material for my coursework easy.	4.330	0.805
I study at my own pace in different environments with my mobile device.	4.246	0.893
I carry my learning anywhere and anytime with ease.	4.182	1.000
I receive real-time information from my peer and instructors with mobile devices.	4.117	0.856
Mobile device helps me access course content quickly.	4.092	1.005
I collaborate through mobile device with my peers and instructors.	3.946	0.991
Mobile learning improves my performance.	3.837	1.005
I use the torchlight of my mobile phone to read	2.936	1.381

Source: Field survey 2021.

medium importance level and are therefore considered highly significant to study respondents. This means that most DE students agreed with the mobile learning benefits raised in this study.

The Relative Importance Index (RII) was used for the analysis of data obtained from the survey about the benefits respondents associate with mobile device usage. The RII indicates the relevance and importance of the benefits ranked. The results in Table 4 reveal that the highest-ranked benefit of using mobile devices for learning activities in Ghana is the functionality of the mobile device makes finding relevant material for students' coursework easy. This is the highest benefit the distance students associate with using mobile devices for studies. The next highest-ranked ranking benefit is the functionality of the mobile device to help students study at their own pace in different environments with a mean value of 4. 246. It can be concluded that all the mobile learning benefits stated in this research are significant for the students' present mobile learning. Even, the lowest criteria rank under mobile learning usage benefits, with the lowest ranking of 0.587, falls within the medium level of importance (0.500).

### 8.2. Qualitative

The narratives of respondents regarding the meanings they assigned to mobile learning showed that they regarded it as anything about the use of Mobile devices and then the internet to learn, join interactive or Zoom classes, participate in online courses from foreign countries, and access learning information or resources at any time. Below are noticeable quotes from some participants:

Commenting on the order of the five highest-ranked mobile learning activities, students presented differing opinions but accepted all the activities as relevant. For instance, some respondents said the following:

According to the respondents, the benefits they derive from using mobile learning are that mobile learning is cost-effective as it reduces transportation costs, mobile learning allows easy access to information, and The use of mobile learning devices makes learning easier and more

Quotes	Themes
<p><i>Mobile learning usage</i>  <i>Mobile learning is the use of mobile devices in learning by using the internet as a medium</i> [UG: Male, Level 200].  <i>“Mobile learning refers to using mobile devices and the internet to access information to learn”</i> [UEW: Male, Level 300].  <i>“Mobile learning means the use of mobile phones to search for information for learning”</i> [UG: Female, Level 400].  <i>“Mobile learning is using any technological device, e.g., mobile phones, laptops, or apps, to connect either for research or to join interactive classes”</i> [UEW: Female, Level 300].  <i>“With the usage of mobile phones, mobile learning entails having access to learning resources at any time”</i> [UG: Female, Level 100].  <i>“I use my smartphone to join study groups on zoom and attend lectures and online courses”</i> [UG, Male, Level 400].</p>	<p><i>Mobile learning is the use of</i></p> <ul style="list-style-type: none"> <li>• Mobile devices and internet to learn.</li> <li>• Phones to join interactive or zoom classes.</li> <li>• Mobile devices to join online courses from foreign countries.</li> <li>• Mobile devices and Internet to access learning information.</li> <li>• Mobile learning to access learning resources at any time.</li> </ul>

understandable through learning platforms than the traditional method. Some participants said the following:

Speaking on the first five highest-ranked benefits, the following are noticeable opinions from the participants:

**Table 4. Relative importance index of mobile learning benefits**

Benefits	RII	Rank
My mobile device makes finding relevant material for my coursework easy.	0.866	1
I study at my own pace in different environments with my mobile device.	0.849	2
I carry my learning anywhere and anytime with ease.	0.836	3
I receive real-time information from my peer and instructors with mobile devices.	0.823	4
A mobile device helps me to access coursework content quickly.	0.818	5
I collaborate through a mobile device with my peers and instructors.	0.789	6
Mobile learning improves my performance.	0.767	7
I use the torchlight of my mobile phone to read	0.587	8

Source: Field survey 2021.

Quotes	Themes
<p>Yes, I agree that students use mobile devices for all the above. In my ranking, I will prefer to rank the highest as indicated in the quantitative, use of a mobile device to communicate with colleagues for information, however, I prefer the fifth-highest use which is “I form networks with peers on the social media platform” [UEW: Male, Level 300].</p>	<ul style="list-style-type: none"> <li>• Mobile learning facilitates the formation of networks among peers on social media platforms.</li> <li>• Students use mobile devices to communicate with their colleagues for information.</li> </ul>
<p>“I agree with the order of importance, I believe that communicating with colleagues for information, follow by, hold of meetings among colleagues and instructors. The next is forming networks with peers on social media platforms and then participating in online courses follow by doing a coursework assignment” [UG: Female, Level 300].</p>	<ul style="list-style-type: none"> <li>• Students use mobile learning devices to communicate with their colleagues for information.</li> <li>• Mobile learning facilitates the formation of networks among peers the social media platforms.</li> <li>• Students use mobile learning devices to do their coursework assignments</li> </ul>
<p>Yes, I agree that students use mobile devices for all the above. In my ranking, I will prefer to rank the highest as indicated in the quantitative, use of a mobile device to communicate with colleagues for information, however, I prefer the fifth-highest use which is “I form networks with peers on the social media platform” [UEW: Male, Level 300].</p>	<ul style="list-style-type: none"> <li>• Students use mobile learning devices to communicate with their colleagues for information.</li> <li>• Mobile learning facilitates the formation of networks among peers the social media platforms.</li> </ul>
<p>“I agree with the order of importance, I believe that communicating with colleagues for information, follow by, a hold of meetings among colleagues and instructors. The next is forming networks with peers on social media platforms and then participating in online courses follow by doing a coursework assignment” [UG: Female, Level 300].</p>	<ul style="list-style-type: none"> <li>• Students use mobile learning devices to communicate with their colleagues for information.</li> <li>• Students use mobile learning to hold meetings with their colleagues and instructors.</li> <li>• Mobile learning facilitates the formation of networks among peers the social media platforms.</li> <li>• Students use mobile learning devices to do their coursework assignments.</li> </ul>
Quotes	Themes
<p>“Mobile learning is cost-effective because it reduces transportation costs” (UG: Male, Level 200)</p>	<ul style="list-style-type: none"> <li>• Mobile learning is cost-effective.</li> <li>• Mobile learning reduces the cost of transportation.</li> </ul>
<p>“Mobile learning allows easy access to information” (UEW: Female, Level 300)</p>	<ul style="list-style-type: none"> <li>• Mobile learning makes easy access to information</li> </ul>
<p>“Learning is made easier and more understandable through mobile learning platforms than the traditional method of learning” (UEW: Male, Level 300)</p>	<ul style="list-style-type: none"> <li>• Mobile learning usage makes learning easier than traditional learning.</li> </ul>

### 9. Discussion

There are numerous advantages to using mobile learning in instructional activities by DE students. The mobility, portability, flexibility, and interactive features of mobile learning allow students to bring their education with them at anytime and anyplace, have the freedom to study at their own pace, and enhance activities that promote collaborative and cooperative learning as well as knowledge sharing among students and tutors (Al-Emran et al., 2016; Crompton, 2013). Shown by the mean responses as well as RII ranking values, DE students have confirmed in order of importance, all the benefits of mobile learning items raised in this study. The mean response values by students on the mobile learning benefits items range from

2.936 to 4.330. The lowest mean response value is above the acceptable region. The implication

Quotes	Themes
<p><i>Mobile learning benefits</i>                      I agree with all the benefits of mobile learning usage. However, in the order of importance, I believe that carrying my learning anywhere and anytime with ease, followed by, a mobile device makes it easy for me to search for relevant information for my coursework and also me receiving real-time information from my peer and instructors with a mobile device will be my order of importance follow by others listed in no particular” [UEW: Male, Level 300].</p>	<p><i>Order of importance</i></p> <ul style="list-style-type: none"> <li>• Carrying of learning anywhere and anytime with ease</li> <li>• Mobile devices make it easy to search for relevant information for coursework.</li> <li>• Mobile learning enables the receiving of real-time information from peers and instructors.</li> </ul>
<p><i>Yes, I agree with the benefits of using mobile learning. In my ranking, I would prefer to rank the highest as indicated in the quantitative results (mobile device makes it easy for me to search for relevant information for my coursework). I prefer carrying my learning anywhere and anytime with ease as the second highest-ranked benefit” [UG: Female, Level 400].</i></p>	<ul style="list-style-type: none"> <li>• Mobile devices make it easy for searching for relevant information for coursework.</li> <li>• Carrying my learning anywhere and anytime with ease</li> </ul>

is that most DE students agreed that mobile learning provides all the benefits raised in the study. Moreover, the values of RII ranking by students on the mobile learning benefits items range from 0.587 to 0.866.

The lowest RII ranking is above the acceptable region, that is, it falls within the medium level of importance. This suggests that although DE students ranked the benefits differently but most of them considered all the benefits of mobile learning as important. Participants declared that they agree with all benefits of mobile learning usage listed in the study. However, in order of importance, they have different opinions. A student believes that carrying out learning anywhere and anytime with ease, followed by, a mobile device that would make it simple for her to search up pertinent information for her coursework and receive real-time information from her peers and instructors with a mobile device is considered her order of importance. Another participant preferred to maintain the first highest-ranked benefit indicated in the quantitative results (a mobile device that would make it easy for me to look up valuable information for my coursework) as his first-ranked item. His second highest-ranked benefit is carrying on learning anywhere and anytime with ease. The high RII ranking values for the first five benefits (0.818 and above) juxtaposed with their respective high mean response values (4.0 and above) show that benefits for using mobile learning regarded highly significant were ranked high or considered as most important.

The findings revealed that the feature for mobile devices that allows students to search for relevant information about their coursework is the most and often significant used mobile learning benefit for DE students. The ability of the mobile device to enable students to study at their own speed is the next highest-ranked benefit. The third and fourth most significant benefits of using mobile learning for DE students, respectively, are the functionality of mobile learning which enables DE students to carry learning anywhere and at any time, and mobile learning, which enables DE students to receive real-time information from peers and tutors.

The next important benefits are that mobile devices help students assess coursework content quickly, mobile learning enhances collaborative learning among students, peers, and tutors, and mobile learning improves students’ performance (Criollo et al., 2021). noted that the most important benefits of mobile learning are instant access to information or the construction of an educational resource and the recording of voice. These quantitative results were confirmed during

the qualitative section as the interviewees agreed on the significance and order of importance of these benefits. Respondents' confirm that the ease, flexibility, and mobility of using mobile learning technologies are the driving force that enables them to stay with mobile learning. A respondent believes that mobile learning is convenient and reduces transport costs.

Taking into account both the quantitative and qualitative findings, the benefits of mobile learning in descending order of priority are; students can easily find relevant information for their coursework using mobile devices; they can learn in a diversity of settings using mobile learning devices, they can easily carry their mobile learning devices anywhere; they can receive real-time information from their peers and instructors using mobile devices, they can quickly access coursework content, and they can improve collaborative learning with their tutors. Mobile learning is cost-effective because it lowers transportation costs; mobile learning provides quick access to information; the use of mobile learning technologies through LMSs makes learning easier and more understandable; mobile learning enables students to conduct independent study and research at their own pace; the torchlight of mobile phones can be used for reading, and mobile learning improves performance.

As demonstrated by mean responses and RII ranking values, DE students confirmed in order of importance all the mobile learning activities raised in this study. The mean response values by students on the mobile learning activities items range from 2.873 to 4.323. The lowest mean response value is above the acceptable region. This means that most DE students agreed to use mobile devices to conduct all the learning activities outlined in this research. The values of RII ranking on mobile learning activities items range from 0.575 to 0.865. The lowest RII ranking is above the acceptable region, that is, it falls within the medium level of importance. The indication is that most DE students considered all the mobile learning activities as important. The high RII ranking values for the first five activities (0.80 and above) juxtaposed with their respective high mean response values (4.00 and above) show that the DE students' mobile learning activities received positive ratings.

Given that their definitions of mobile learning were quite close to those found in the literature, the students demonstrated a solid comprehension of both its meaning and applications. For instance, participants believed that mobile learning is using any technological device, such as smartphones or mobile phones, laptops, or apps, and wireless transmission to connect either to join interactive classes or to undertake online courses. Others explained that mobile learning is used to access learning resources at any time using mobile phones, or the use of mobile devices to join study groups on Zoom and attend lectures. Besides, the participants revealed that students can use mobile learning for research. Scholars like Cavus and Al-Momani (2011) noted that mobile learning is the use of mobile technologies to communicate, negotiate, and dialogue effectively by students and tutors for information at any place at any time.

Mobile learning enables distance learners to access information with ease, participate in collaborative and cooperative learning, and share knowledge (Crompton, 2013; Kankam & Wang, 2011). The most important and frequent DE students' mobile learning activity is communication among colleagues for information. This is followed by the undertaking of online courses and thirdly, doing coursework assignments. The next activities in order of importance are holding meetings among colleagues and instructors, formation of networks with peers on social media platforms, and engaging of course group discussions. The others are the usage of mobile devices to record and listen to the voices of instructors in class, due course presentations, conduct quizzes, and examinations, and take courses, videos, and pictures.

Rapid access to information, the creation of educational resources, and voice recording are often the most notable uses of mobile learning. Social networking is a more convenient option for teachers and students to actively communicate. Giving importance to the uses of mobile learning, respondents gave differing orders of importance just as in the quantitative stage. For

instance, while some students prefer to rate the forming of networks on social media first, other students consider communicating with colleagues for information as the most important usage.

Integrating the outcome of quantitative and qualitative stages established that to participate in mobile learning activities, DE students must use mobile learning technologies. These technologies can be used to communicate with their colleagues, take part in online courses, complete coursework, meet with instructors and colleagues, listen to voice recordings in class, make presentations, take part in evaluation activities (quizzes and surveys), administer exams, and take videos and pictures.

## 10. Conclusion

The students access information via the predefined programme (SAKAI and Moodle Learning Management Systems (LMS)) using mobile devices. Students can negotiate and work together to complete the objectives of their learning activities using the groups, chat, and forum components of the LMS. Throughout the process, students engage in group discussions and collaborate with one another to modify their pre-existing knowledge schema and create new information. Tutorials take place on Saturdays and Sundays, and lecturers deliver lessons using a computer, a projector, whiteboards, and other teaching aids. Tutors assist in setting up and distributing the questions to the students and then collect the students' work later.

The two universities' distance education curricula encourage students to create networks and platforms on social media sites like Facebook, YouTube, and WhatsApp that let users engage in asynchronous learning on mobile devices. In addition to text messages, social media platforms like WhatsApp and others can offer images, videos, and audio samples that students may download, record by themselves or with their peers, and listen to on the go. These cooperative exercises inspire and help numerous students to consider a variety of options and alter their perspectives on learning. An individual student can also use their mobile phones to ask their tutors questions, and the tutors can immediately answer them orally thus encouraging a decrease in transactional distance.

The results show that the students have adequate knowledge about mobile learning and use mobile learning widely to enhance their learning activities. Students use mobile devices for various learning activities including communicating with colleagues for information, participating in online courses, doing coursework assignments, holding meetings among colleagues and instructors, engaging in course group discussions, sharing information, doing course presentations, joining interactive or Zoom classes, and conducting examinations with their mobile devices through learning management system platforms as evidenced by this study. Although students rank mobile learning activities differently, it can be inferred that all these activities are crucial to the improvement of students' studies because of the high ranking of importance of the activities.

This study shows the benefits distance learners at UG and UEW enjoy from using mobile learning. The benefits include enhancement of collaborative and cooperative learning among students and tutors, access to learning resources, and carrying of learning anytime and anywhere with less difficulty as well as receiving real-time information from peers and tutors with a mobile device. The students not only agreed with all the benefits of this study but view them as particularly important. Besides, they revealed other important benefits of mobile learning. It can be concluded that the benefits of using mobile learning have a significant impact on the actual use of mobile learning technologies, so students continue to exploit these benefits.

## 11. Recommendations

The findings of the study show that mobile learning has benefits that make it an excellent tool for learning. There is, however, no clear policy directive or regulation that backs the appropriate use of mobile learning by students. From this, future research should investigate the policy implications of mobile learning integration into Ghanaian distance education pedagogy. It will assist educators

and students to appreciate the various dimensions of ML use. It will also encourage and guide DE students to maximize the benefits of mobile learning for the realization of its full potential. The results of the study reveal that the students have a high understanding of mobile learning and extensively use it for learning purposes, mostly via a learning management system. All the students, therefore, rank these activities as particularly important to their studies.

However, apart from the provision of learning management systems, students integrate these activities into teaching and learning by themselves informally without or with little support from the public university authorities. There is therefore the need for an integrated policy directive that would formalize and support the effective adoption of mobile learning into pedagogy in distance education institutions in Ghana. Distance education institutions should build strategic mobile learning implementation plans and design guidelines for the development of mobile learning by taking into consideration the highest-ranked important benefits and uses of mobile learning identified in this study. Finally, this study adopted a mixed-method approach to establishing distance education students' mobile learning pedagogical activities and benefits. It is recommended that future studies should be designed quantitatively to provide an in-depth determination of the actual effect of students' mobile learning benefits and activities on their academic performance.

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#### Disclosure statement

No potential conflict of interest was reported by the author(s).

#### Compliance with ethical standards

The authors do not have any issues of potential conflict. This research involved the use of human participants. However, all issues of ethics and human research subjects were duly complied with, and the research was approved to proceed by the Ethical Committee of the Humanities, University of Ghana with ethical clearance number ECH 161/20–21. Informed consent was duly sorted and obtained from all research subjects.

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