Mobile information behaviour of sandwich students towards mobile learning integration at the University of Ghana

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Abstract: In Ghana, sandwich students are in accelerated programmes and education are offered to them during vacation periods. Like other forms of education, it has been found that the integration of mobile learning with sandwich programmes would be beneficial. However, the need to explore students’ readiness and attitudes towards M-learning before its integration is crucial. This study therefore looked into sandwich students’ mobile information behaviour to ascertain their readiness for M-learning adoption. Through a survey research method, the study used a quantitative approach to look into this phenomenon. Forty (40) sandwich students from the University of Ghana participated in the study and data were collected through the use of the questionnaire. The sandwich students perceived integration of M-learning to be beneficial. The results of the study also show that the participants own mobile devices, but a significant number of them were of the view that their mobile devices would not enable M-learning adoption to be effective. The study recommends training on mobile information retrieval skills to students for effective M-learning adoption.

Keywords: mobile learning; sandwich students; information; behaviour; integration; adoption

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PUBLIC INTEREST STATEMENT
The use of mobile devices is rapidly integrating into all features of life especially within academic environments. Mobile learning, a new learning approach that occurs through the use of mobile devices is currently changing how students communicate, interact with their instructors and themselves as well as their perceptions towards learning. In order to explore sandwich students who are enrolled in accelerated programmes’ readiness and attitudes for M-learning, the study examined their mobile information behaviour towards effective and efficient integration of M-learning. The study found that students’ mobile penetration and ownership are not just enough ground for M-learning adoption. The results can contribute to stakeholders’ effective strategies for the adoption and development of M-learning.
1. Introduction
The development of mobile devices and Information & Communication Technology (ICT) capabilities are gradually changing the characteristics of tertiary education worldwide (Liaw et al., 2010). The ICT tools and capabilities are noted to provide students with a self-paced, adaptable, and obliing learning context with little constraints to remain competitive in this technological age (Mouza & Barret-Greenly, 2015). More significantly, the use of mobile devices is rapidly integrating into all features of life especially within academic environments. Mobile device ownership has detonated with a large number of people owning more than one mobile device (Statista, 2016). Sandwich students are enrolled in accelerated academic programmes and are potentially well positioned to take advantage of these ICT benefits.

The largest demographic of mobile device users is found to be at the age range of 18–29 years, the typical age of tertiary students (Pew, 2017). Currently, “the usage of mobile technology has become crucial for higher educational institutions worldwide due to the wide spectrum of its benefits” (Al-Emran et al., 2016, p. 94). Recent study results signify that mobile learning is being used to support students’ learning at the tertiary educational levels (Ke & Hsu, 2015). This clearly depicts that the speedy development and implementation of mobile technologies are positively changing the modes of teaching and learning in the field of education (Al-Khowarizmi et al., 2020; Cavus, 2011).

Moreover, mobile devices have been embraced at an unprecedented rate in the past years and the statistics show that 95% of the global population are living in areas covered by a mobile-cellular network (ITU, 2016). Mobile learning (M-learning), a type of learning that is employed through the use of small computing mobile devices has now gained approval among teachers and students due to its flexible and comfortable style (Mcconatha et al., 2008). Various universities worldwide are applying M-learning to deliver learning solutions to students anytime and anywhere in different ways (Enriquez, 2010).

As maintained by Gikas and Grant (2013), the mobile technology has turned out to be a connected part of the learning process within the tertiary educational level. The technology presents many opportunities and challenges to both lecturers and students. Thus, looking into M-learning in this technological age is essential since it is a study trend that draws researchers to explore mobile technology, investigate its impacts on teachers and students so as to develop the required infrastructure for its effective and efficient implementation (Al-Emran et al., 2016).

2. Problem and need for the study
In this information age, students access smartphones constantly on a daily basis and this provides a logical basis to extend M-learning to them (Leung & Cheng, 2019). M-learning is gradually penetrating the traditional teaching and learning “by integrating the mobile technology Apps which could be the ‘new-breath’ in almost all of the classrooms whether in direct or indirect ways” (Al-Emran et al., 2016, p. 94). The M-learning technology therefore presents a great opportunity for tertiary institutions to extend the traditional educational engagements to students outside the classroom setting. A section of students that can benefit immensely from the M-learning opportunity is the sandwich students.

In Ghana, Sandwich education refers to education where students move into the various tertiary institutions during vacation periods when the full-time students’ academic activities are not in session. Unlike distance education students, sandwich students have academic engagements with their lecturers when they are physically present on campus during their academic sessions. Sandwich education at the University of Ghana is mainly for postgraduate studies and this level of education needs continuous engagements to be successful especially towards dissertation works. Integrating M-learning into this type of education has a huge potential to provide flexibility for the sandwich students to learn with their own devices for rich academic interaction and also to provide them the opportunity to access rich resources anytime and anywhere (Sheppard, 2011).
Nevertheless, the need to explore students’ readiness and attitudes towards M-learning such as examining their mobile information behaviour before its integration cannot be overemphasised. Certainly, exploring students’ mobile information behaviour towards the integration of M-learning goes a long way in assisting stakeholders within the sector to plan and take the needed steps for M-learning adoption. Such a study provides the basis for the appropriate infrastructure design towards effective and efficient M-learning implementations. For example, it was uncertain how many sandwich students owned mobile devices and how many can effectively and efficiently access academic and scientific information contents via mobile devices. The study therefore looked into sandwich students’ mobile information behaviour towards the integration of M-learning and the following objectives were explored:

- RO1: Ascertaining sandwich students’ ownership of connected mobile devices.
- RO2: Investigating sandwich students’ mobile information retrieval competencies.
- RO3: Looking into sandwich students’ mobile information behaviour challenges.
- RO4: Exploring sandwich students’ perception on M-learning.

3. Literature review

3.1. Conceptualisation of M-learning

Mobile learning denotes a form of learning that involves the use of mobile devices and could be defined generally as “learning across multiple contexts, through social and content interactions, using personal electronic devices” (Crompton, 2013, p. 4). M-learning could be seen as the next generation of electronic learning (e-learning) that uses mobile technology (Alzaza & Yaakub, 2011; Fatima et al., 2019; Golenhofen et al., 2020; Leung & Cheng, 2019). It is therefore a new learning approach that occurs through the use of mobile devices (Quinn, 2000; Qureshi et al., 2020). Particularly, M-learning could be regarded as a subset of e-learning and it is accessed in educational environments where the technologies are characterised by wireless and personal devices (Cho, 2007).

E-learning occurs on the internet and mobile learning presents learning opportunities that are provided through mobile networks with internet connectivity (Okai-Ugbaje et al., 2020). The connectivity feature enables M-learning to offer interactive experiences that could be structured with sharing, exploration, and application (Cavus & Ibrahim, 2009; Golenhofen et al., 2020). M-learning technology currently is changing how students communicate, interact with their instructors and themselves as well as their perceptions towards learning (Al-Siyabi & Dimitriadis, 2020; Homan & Wood, 2003). For example, Matias and Wolf (2013) opined that M-learning is not just about learning that is grounded on the use of mobile devices but also the learning that is facilitated across multiple contexts through the use of portable mobile devices. It could be deduced that M-learning is an emerging concept that has great links with distance education (Mirski & Abfalter, 2004). In sum, M-learning could be described as the use of mobile technology for educational purposes (Kinash et al., 2012).

3.2. Features of mobile learning

3.2.1. Mobility

Mobile devices are currently used by students to retrieve learning resources and communicate with their lecturers and other students irrespective of where they are (Cavus & Ibrahim, 2009). As indicated by Cavus (2011), M-learning is characterised by students’ ability to access learning resources anytime and anywhere through the use of mobile devices. This shows that M-learning concentrates on the mobility of devices that can retrieve information and these mobile devices are regarded by students who own them as friendly and personal tools (Traxler, 2007).

3.2.2. Portability

Mobile devices are relatively smaller and light weighted making them easier to be carried around. Its portable feature provides students the avenue to learn anytime, anywhere making it ubiquitous
since it transmutes the traditional classroom environment into an ever-present educational setting (Kukulska-Hulme et al., 2009).

3.2.3. Multimedia and other blends
M-learning has a blended feature that makes it possible for institutions to merge it with traditional learning and this has the potential of maximising face-to-face as well as online engagements (Al-Sharhan, 2016). It thus allows educational settings to shift anytime and anywhere towards the experience of personalised learning. M-learning studies attempt to enlarge the values of mobile technologies, especially in tertiary institutions without negating the educational mission. The technology therefore provides new openings for teaching and learning since M-learning supports multimedia and also promotes dynamic learning content (Leung & Cheng, 2019).

3.2.4. Interactivity
The newest method of learning introduced in the educational sector is M-learning (Ebrahim et al., 2015). M-learning is noted to be interactive and this feature creates cooperative learning activities with an immediate feature that enables prompt access to learning resources and instruction as well as prompt feedback (Eteokleous & Ktoridou, 2009).

3.3. Advantages of M-learning
The increased ubiquity of mobile devices invents potential choices for students to explore mobility as an instructional method through M-learning and this feature leverages students’ ability to face unfamiliar situations (Pachler et al., 2010). Certainly, the features of M-learning present many opportunities for students and teachers:

3.3.1. Mobility
The mobility advantage of M-learning has been found in many studies and it has been reported in one of such studies that M-learning “has dealt with mobility from a number of dimensions: mobility of technology, mobility of learners, mobility of educators, and mobility of learning” (Al-Emran et al., 2016, p. 94).

3.3.2. Multimedia and interactivity
With M-learning, students are able to integrate learning resources from both online and offline settings (Chen & Huang, 2012). It has useful characteristics such as mobile search, social networking, and image capturing through the use of cameras. It also possesses a self-directed learning feature which allows M-learning students to personalise their studies. Through M-learning, students are able “to learn, collaborate, and share ideas through the internet and m-learning system” (Qureshi et al., 2020, p. 68).

3.3.3. Portability
It enables students to transport their learning experience anywhere at any time without any or much difficulty. Again, mobile devices that are used for M-learning are easily portable with prompt off/on button (Crompton, 2013).

Mobile learning is relatively seen as a “new phenomenon, but the effectiveness of the tool is countless in terms of high-quality education and learning process” (Qureshi et al., 2020, p. 67). When M-learning is well integrated in the educational process, it assists students to raise their “technological awareness, make conversations, join social media, find answers to their questions, facilitate team collaboration, allow knowledge sharing, and also leverage their learning outcomes” (Al-Emran et al., 2016, p. 94). Successful integration of M-learning has positive impacts on students, and it has been found that the overall effect of mobile devices appears to be better for learning than the use of desktop computers or not using devices at all (Sung et al., 2016).
3.4. Effective integration of M-learning in education
Measuring students and teachers' M-learning self-efficacy, subjective control, mobile-assisted learning competencies, and their target-based behaviours is important towards the successful integration of M-learning (Tagoe & Abakah, 2014). It is an essential requirement for teachers and students to own a mobile device for the successful implementation of M-learning (Cushing, 2011). Research has established that the mobility and interactivity features of M-learning are vital to the successful integration of the technology into educational environments (Alhazmi & Rahman, 2012). It is therefore important for M-learning developers to design and develop applications that have effective interaction styles, attractive and easy to use interface, and a pleasant visual design (John & Govender, 2020; Kukulska-Hulme et al., 2009).

For M-learning integration to be successful, educational mobile tools and applications should not thwart the learning process, but simplify mobile learners’ learning (Jeng et al., 2010). The challenge here is that, some instructional usage of mobile devices tends to result in negative occurrences for students who have difficulty with the mobile devices as well as applications that are employed for its usage (Ting, 2012). Technical support is therefore important to all stakeholders involved in the M-learning implementation, and this support needs to be continuous (Benali & Ally, 2020; Mahruf et al., 2010). Another issue that needs to be tackled towards effective and efficient integration of M-learning is its lack of effective models that limits the widespread adoption of the technology (Messinger, 2012).

3.5. Mobile information behaviour
Mobile information behaviour is activities that information users conduct on a mobile device, be it goal-directed searching or just surfing without a specific purpose. Information users have adopted the use of mobile devices for internet access at a faster rate than any technology device (Farago, 2012). Clearly, most mobile device users relish many forms of Internet access. Accessing the Internet through smartphones has been found to provide information users the advantages of mobility and portability which in some ways afford “even greater convenience and more continuous use” (Mossberger et al., 2017, p. 1589).

Most students are found to access online information and resources through mobile devices because they are less expensive than laptop and desktop computers (Mossberger et al., 2017). Nevertheless, mobile devices as compared to laptop and desktop computers have small screen sizes and keyboards that make them difficult to use for many online activities (Wortham, 2011). A study by Smith and Page (2015) found that almost half of users who accessed the Internet via mobile devices such as smartphones had difficulties in accessing online contents.

3.6. Studies related to students’ mobile information behaviour
A study conducted by Lipsman and Lella (2017) found that smartphone applications are major tools that influence the mobile behaviour of people from all generations. These applications are mostly used to access online information and it has been established that students particularly prefer “searching information using mobile apps” (Deodhar, 2013, p. 2). Tang and Oh (2017) investigated the mobile information behaviour of students and concluded that students heavily rely on mobile apps for searching, reading and sharing of information.

Emanuel (2013) in his study conducted on undergraduate students maintained that most students were heavily engaged in social communication with the majority of them using their mobile devices “to get information they need right away” (p. 12). Dresselhaus and Shrode (2012) also examined students’ mobile information behaviour and their study concluded that the majority of the students used connected mobile devices for their academic activities.

3.7. Sandwich education in Ghana
Sandwich education is a form of education where students enter into academic institutions of study during vacation periods when the full-time students of those institutions are on holidays. The
length of study for this academic programme is typically flexible and shorter compared to the regular sessions and students are made to study within short periods of time (Holmberg, 2005). For example, what a regular student would study within a 16-week semester, would be studied by a sandwich student within eight (8) to nine (9) week period. Clearly, sandwich programmes comprise intensive courses that are packed with lectures to enable students complete their sessions before full-time students’ academic programmes are resumed. Students who enrol in sandwich programmes could be classified as non-traditional students since they only move to the institutions of study during holidays and their study programmes are “sandwiched between the end of academic year (second semester) and the first semester of the following academic year” (Tamanja, 2016, p. 96).

At the University of Ghana, sandwich programmes are run mainly on postgraduate courses with Master of Arts (M.A.) programmes being predominant. These programmes have provided educational opportunities for students who cannot enrol on full time and have therefore enrolled many students who for numerous reasons were not able to avail themselves for regular academic programmes (Tamanja, 2016). Comparatively, sandwich students are able to access housing facilities and other academic facilities on campus with ease because they get to campus at the time that regular students are on holidays (Kwadzo, 2014).

4. Methodology
The survey research method was employed by the study to examine the mobile information behaviour of sandwich students at the University of Ghana (UG). The survey method was appropriate for this study because the study sought to examine behaviour and “for generalization about the attitudes of a population, collection of quantitative opinions, using quantitative surveys is appropriate” (Guthrie, 2010, p. 46). Hence, the quantitative research approach was employed for the study and data were collected through the use of the questionnaire. The questionnaire was divided into five parts to reflect the objectives of the study. Part A sought to collect demographic data of the respondents; Part B sought data on participants’ mobile device ownership; Part C sought data on participant’s mobile information retrieval skills; Part D sought data on participants’ mobile information behaviour challenges; and Part E sought data on participants’ perception of M-learning.

At the University of Ghana, sandwich programmes are largely on postgraduate courses and few of the academic departments run sandwich programmes. The Department of Information Studies (DIS) is one of the departments that run sandwich programmes at UG. The DIS run five programmes in information studies—Diploma, Bachelor of Arts, Master of Arts, Master of Philosophy and Ph.D.—but only their Master of Arts (M.A.) programme is offered to sandwich students. The study was therefore conducted among the MA sandwich students of the DIS. Due to the number of the population (40 students), all the population were included in the study (census), hence, no need for selection. The questionnaires were hand-delivered to the respondents in a classroom setting after consent had been sought from the DIS and the students. The respondents were asked to return the questionnaires to a designated point after completion and analysis of data were done through the use of SPSS v.21.

5. Results

5.1. Demographics
A total of 40 questionnaires were distributed to the sandwich students and 36 of the questionnaires were returned. This shows that the study achieved 90% response rate. The analysis of the data reflected that 23 (63.9%) of the respondents were males and the remaining 13 (36.1%) were females. Moreover, the analysed data showed that 11 (30.6%) of the respondents were between the ages of 31–35, 8 (22.2%) of them were within the age range of 36–40 years and another 8 (22.2%) of the respondents were beyond the age of 40 years. Seven (19.4%) of the respondents were between the ages of 26 and 30 years with the remaining 2 (5.6%) of the respondents at the age range of 20 and 25 years.
6. RO1: Ascertaining sandwich students’ ownership of connected mobile devices

6.1. Connected mobile device ownership
Respondents were asked to indicate the type of connected mobile devices they owned. The responses from the participants as depicted in Table 1 indicate that 34 (94.4%) of them owned connected smartphones, 4 (11.1%) of them owned tablets and none of the respondents owned an e-reader device or any other mobile device.

6.2. Mobile operating systems
Sandwich students who owned connected mobile devices were asked to indicate the operating system that powers their devices. The responses as presented in Table 2 show that 30 (88.2%) out of the 34 respondents had their smartphones powered by Google’s Android operating system, and the remaining 4 (11.8%) of them had their smartphones powered by Apple’s iOS. With respect to 4 respondents that owned tablet mobile devices, the results of the study revealed that 2 (50%) of them had their tablet devices powered by Microsoft’s Windows operating system as well as a device each powered by Android and iOS, respectively.

6.3. Internet access at home
The study looked into the Internet accessibility of the sandwich students. Particularly, the study was interested in finding out if the respondents were able to access the internet constantly when they leave campus and the type of internet networks they were able to use to access the internet constantly. The analysed results show that the only internet network that the sandwich students were able to access the internet when they leave school was the cellular networks. The responses from the participants further show that 34 (94.4%) of the respondents were able to access the internet constantly via cellular networks whiles they are not on campus.

7. RO2: Investigating sandwich students’ mobile information retrieval competencies

7.1. The use of internet browser on mobile devices
This section probed into internet browsers that respondents frequently used to access the internet on mobile devices. Multiple responses were received from respondents on this section and the results show that 32 (88.9%) of the respondents frequently accessed the internet on mobile

| Table 1. Mobile device ownership (N = 36) |
|-----------------------------------------|
| Item                      | Yes | No |
|----------------------------|-----|----|
| Smart phones              | 94.4| 5.6|
| Tablet                    | 11.1| 88.9|
| E-book reader             |     | 100|
| Other                     |     | 100|
| Total                     | 100 | 100|

| Table 2. Type of mobile operating system (N = 36) |
|-----------------------------------------------|
| Item              | Smartphone | Tablet |
|--------------------|------------|---------|
| Android            | 88.2       | 25      |
| iOS                | 11.8       | 25      |
| Windows            | -          | 50      |
| Total              | 100        | 100     |
devices through the use of Google Chrome internet browser, followed by Mozilla Firefox with 22 (61.1%) responses, then Internet Explorer/Microsoft Edge with 15 (41.6%) responses and lastly Safari with 2 (5.6%) responses.

7.2. Reasons for the use of mobile applications
The study sought to find out the reason behind respondents' choice and use of mobile applications and it was revealed as presented on Table 3 that all the respondents—36 (100%)—were interested in using mobile applications that were user-friendly, 30 (88.2%) of the respondents used mobile applications that worked better with their devices, 18 (50%) were interested in mobile applications that were quicker and 7 (19.4%) of the respondents were interested in mobile applications that had extensions.

7.3. Frequently used mobile applications
In order to examine respondents' information retrieval behaviour on mobile devices, they were asked in an open-ended question to indicate their three most frequently used mobile applications. Five of the highest ranked mobile applications were analysed and reading from Table 3 all the respondents (100%) indicated that Whatsapp is the most frequently mobile app they used hence, Whatsapp mobile application been the highest ranked mobile app used by the sandwiched students. This was followed by Facebook application with 26 (72.2%) of the responses and Internet browsers with 21 (58.3%). Email mobile application was ranked fourth with 17 (47.2%) of the responses followed by SMS application with 12 (33.3%) of the responses.

7.4. The use of mobile device to seek academic-related information
The respondents were asked to indicate how often they accessed academic information through the use of mobile devices. The responses from the participants show that 28 (77.8%) of them “Always” accessed academic information via mobile devices and the remaining 8 (22.2%) of them “Sometimes” did so.

7.5. Perceived mobile information retrieval skills
It is important to have the necessary skills in order to retrieve relevant information via mobile devices. The study therefore sought from the respondents their perceived mobile information retrieval skills, and the responses from the participants show that 32 (88.9%) of the respondents perceived that they possessed the needed mobile information retrieval competencies. The

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**Table 3. Mobile app and browser usage (N = 36)**

| Browser feature              | %   |
|------------------------------|-----|
| User-friendliness            | 100 |
| Works better with device     | 88.0|
| Quicker                      | 50  |
| Has extensions               | 19.4|

| Frequently used mobile app   | %   |
|------------------------------|-----|
| Whatsapp                     | 94.4|
| Facebook                     | 72.2|
| Internet browser             | 58.3|
| Email                        | 47.2|
| SMS                          | 33.3|
remaining 4 (11.1%) of them perceived themselves not to have the required skills to effectively retrieve information via mobile devices.

7.6. The types of documents retrieved via mobile devices
Respondents were asked to indicate their ability to access, retrieve and use certain types of documents via mobile devices. Reading from Table 4, 26 (72.2%) of the respondents indicated their ability to retrieve and use Pdf documents via mobile devices, 23 (63.9%) of them were able to retrieve and use Word documents via their mobile devices and 29 (80.6%) were able to access PowerPoint documents via their mobile devices. Moreover, 32 (88.9%) of the respondents indicated their ability to access video contents from their mobile devices and 34 (94.4%) of them were able to access audio contents from mobile devices. However, 22 (61.1%) of the respondents were not able to retrieve Spreadsheets from their mobile devices.

8. RO3: looking into sandwich students’ mobile information behaviour challenges

8.1. Mobile information behaviour challenges
This section explored the difficulties that inhibit sandwich students to effectively and efficiently access, retrieve, evaluate and use information via mobile devices. The responses from the participants as presented on Table 5 show that screen sizes of mobile devices pose a challenge to 28 (77.8%) of the respondents, 22 (61%) of the respondents were faced with Internet access difficulties and 18 (50%) of the respondents observed that mobile applications were not user-friendly. Moreover, 14 (38.9%) of the respondents asserted that they lacked the needed devices to be effective and 8 (22.2%) of them indicated that they lacked the skills to retrieve information via mobile devices.

9. RO4: exploring sandwich students’ perception on M-learning

9.1. Integration of M-learning
The study sought to investigate participants’ perceptions on the need to integrate M-learning in their current programme of study. They were therefore asked to indicate whether or not M-learning should be integrated into the sandwich programme. From the responses, 26 (72.2%) of

| Document type          | Yes | No |
|------------------------|-----|----|
| Audio files            | 94.4| 5.6|
| Video files            | 88.9| 11.1|
| PowerPoint documents   | 80.6| 19.4|
| Pdf documents          | 72.2| 27.8|
| Word documents         | 63.9| 36.1|
| Spreadsheets           | 38.9| 61.1|

| Challenges             | %   |
|------------------------|-----|
| Screen size            | 77.8|
| Internet access        | 61.1|
| User-friendliness of apps | 50  |
| Mobile devices         | 38.9|
| Retrieval skills       | 22.2|
| Other                  | -   |
the respondents were of the view that M-learning should be integrated with the sandwich programme and 10 (27.8%) of them were not in support of the integration of M-learning with their academic programme.

9.2. Possession of the needed training and skills to be effective in M-learning integration
The participants were asked to indicate whether or not they have acquired the needed training and skills to be effective and efficient in M-learning. The responses from the respondents attest that 22 (61.1%) of the respondents had not acquired the needed training and skills to be effective in M-learning and the remaining 14 (38.9%) of them had acquired the needed training and skills in M-learning.

9.3. Integration of academic activities with mobile learning
The study sought to find out from the sandwich students, the academic activities they would prefer the institution to integrate with M-learning. Out of the 36 responses, 32 (88.9%) of the respondents would like the supervision of their dissertations to be integrated with M-learning, 30 (83.3%) of them would like to access lecture notes via M-learning, 27 (75%) of the participants would like their class assignments to be integrated with M-learning and 12 (33.3%) of the participants would like quizzes to be conducted via M-learning platform. The responses are presented in Table 6.

10. Discussion
Currently, the mobile technology market has provided enough “room to expand for m-learning in developing countries and understanding the factors that lead to the adoption of m-learning is crucial” (Fatima et al., 2019, p. 420). Important of these factors is the mobile information behaviour of the potential M-learning users. These behaviours include the actions that users manage on mobile devices and ascertaining them is a major factor that could establish grounds for M-learning adoption (Tagoe & Abakah, 2014; Ting, 2012). Clearly, this study examined the mobile behaviours of adult students since the results depict that majority (75%) of the participants were more than age 30.

For M-learning to be implemented successfully, it is crucial for its users to own a mobile device (Cushing, 2011). The findings of this study show that almost all the respondents own mobile devices. Particularly, more than 94% of the respondents own smartphones and this to some extent provides a potential environment for M-learning integration among the participants. It was clear from the findings that the use of Google’s Android platform was common among the participants. In effect, the designing of M-learning platforms for the participants should take into account infrastructure that would be compatible with the Android platform to make adoption smooth. This stems from the fact that the respondents believed that Android platforms were user-friendly because all of them (100%) posited that their quest to use mobile application lies on the user-friendliness of the mobile application.

M-learning adoption involves information seeking and retrieval activities. It was evident from the responses that the majority (77.8%) of the respondents used mobile devices to access academic information all the time. Again, almost 90% of them perceived that they had the needed competencies to effectively and efficiently retrieve information from mobile devices with more than 60% of them believing that they possess the needed M-learning skills. Interestingly, however, a very

| Activities               | %   |
|-------------------------|-----|
| Supervision of dissertation | 88.9 |
| Lecture notes           | 83.3 |
| Assignments             | 75  |
| Quizzes                 | 33.3 |
| Other                   |     |
significant number of the respondents indicated their inability to retrieve and use information document types that are critical for M-learning adoption. For example, the majority (61.1%) of the respondents were not able to access Spreadsheet documents from mobile devices and more than one-third (36.1%) of them were not able to retrieve and use Word documents from their mobile devices. These clearly present mobile information retrieval challenges among the participants that need to be addressed for effective and efficient M-learning integration (Kankam & Nsibirwa, 2019).

Moreover, the results of the study depict that the sandwich students perceived M-learning to be beneficial to their academic pursuit. Over 70% of the sandwich students were ready for M-learning integration and it was evident that all the participants had in mind at least an academic activity that they would like the institution to integrate M-learning with. Chiefly among the academic activities were dissertation supervision and lecture notes. These notwithstanding, the participants were of the view that constant internet access and their mobile devices especially the screen sizes of their mobile devices would pose challenges to their M-learning adoption.

11. Conclusion and recommendations
This study looked into sandwich students’ mobile information behaviour with the purpose of establishing grounds towards possible integration of mobile learning in their academic pursuit. It is evident from the study that mobile penetration among the students is encouraging and presents a good potential for M-learning to be effective. Nevertheless, it is important for standards of mobile devices for M-learning to be established and such devices made available to students for effective and efficient M-learning adoption. Although the majority of the participants owned mobile devices, a significant proportion of them indicated that their mobile devices would not enable them to adopt M-learning effectively.

In relation to implications for practice, the study exhibits that it is important to associate M-learning with potential users’ mobile information behaviour. Significantly, the assessment of the sandwich students’ mobile information seeking and retrieval competencies established that the participants require some level of training to be effective. It is therefore important for training on mobile information retrieval skills to be instituted for students before M-learning adoption. Such trainings should be continuous due to constant advancements in technology.

Moreover, an advantage of Mobile learning is its potential for quicker access to information and wide reaching out to students who are widespread geographically. The mobility of the M-learning technology as shown by the study is a particular aspect that provides tremendous implications for its integration to reach out sandwich students for academic engagements. The study has also pointed out the need for the design of the M-learning technology to be user-friendly. Here, the implication lies in the importance of getting the technology right in relation to its processes, sets of rules, models and approaches for better integration of M-learning to benefit both lecturers and students.

The present study expands the theoretical frontier in many ways. For example, the study confirms that establishing the mobile information behaviour of target users leads to positive design, implementation and adoption of M-learning (Tagoe & Abakah, 2014). The study has brought to light the potentials and challenges of M-learning integration among the study population. Moreover, the study has extended further the discussion on non-traditional students’ M-learning potential adoption and has also negated the assumption that students’ mobile penetration and ownership are just enough ground for M-learning adoption. Particularly, the study results show that the participants own mobile devices, but a significant number of them believed that their mobile devices would not enable M-learning adoption to be effective.

12. Recommendation for further studies
The study has limitation by examining mobile behaviour of only the students towards M-learning adoption as well as using only one department of UG, whereas looking into the behaviour of the lecturers as well as employing all the departments that run sandwich programmes at UG for the study would produce a better understanding of M-learning integration among sandwich students.
When funding and other resources are available, further studies are recommended to look into these and possibly extend to other universities in Ghana that run sandwich programmes.

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