Assessing Adoption and Implementation of Mobile Technology-Based Library Services in Academic Libraries

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Abstract: Mobile Technologies (m-tech) have been embraced by stakeholders of academic libraries globally in recent times as a medium that can offer convenient library services to library patrons. This study was to ascertain the potentials of adopting and implementing m-tech based library services in academic libraries in Ghana. The study was a descriptive survey and the mixed-method approach was used. The major findings were that there were a strong awareness and deep appreciation for the use of m-tech library services among library management and students, however, m-tech based library services have not been implemented in the libraries due to diverse reasons. These include inadequate ICT infrastructure, skills gap as a result of lack of training, lack of policy framework for the adoption of the technology and clearing the hurdle of convincing university management to accept the technology. As a result, it was recommended that the libraries need to invest more in ICT infrastructure specifically m-tech infrastructure and build on their human resource base through recruitment and professional training on emerging technologies

Keywords: mobile technology, mobile device, academic libraries, technology,

I. INTRODUCTION

Academic libraries in the 21st century are moving from traditional service provision (hard/physical) to a more contemporary service provision (virtual/ICT). The embracement of contemporary services like ICT related service provision by academic libraries is informed by the growing demand of users across many different geographical locations and convenience. The way users access and retrieve information is being changed by m-tech applications and service innovations (Li, 2013). M-tech has become the key to the accomplishment and modernization of the services of academic libraries (Barile, 2011). Kumbhar and Pawer (2014) opined that m-tech's and availability of easy to use mobile devices have introduced a "libraries in hand" trend.In recent times, more and more libraries around the globe especially those in developed countries are adopting and integrating m-tech's to provide innovative services and provide boundary-less access to unlimited electronic information resources for library patrons (Wang, Ke, & Lu, 2012). Chang (2013) and Zha, Zhang, Li, & Yang (2016) cited North Carolina State University library, Cambridge University Library, and Amsterdam University library as some of the libraries providing a variety of m-tech based services for their users.

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In Africa, universities such as the University of Pretoria, University of Swaziland, University of Kwazulu-Natal and the University of Free State have all adopted the use of m-tech in the provision of library services (De Wee, 2015; Paul & Mavuso, 2012). Despite the growing usage of mobile devices among students and the availability of mobile broadband and WIFI internet almost everywhere in the developing countries (Rogers, 2012), academic libraries in Ghana are yet to fully exploit this opportunity and provide m-tech based library services. A Jumia Annual Mobile Report (2018) indicated that mobile devices subscription in Ghana is anticipated to reach about 40 million in the next two years. The report further stated that by 2021 Ghana's mobile devices penetration will witness over 130% growth and that currently, Ghanaians are among the top mobile device users in Africa. From preliminary observation, the academic libraries have to some extent automated most of their library operations. The libraries are increasingly integrating technologies like online public access catalogue (OPAC) in their operations. They have digitized most of their thesis collections and have other electronic resources. In addition, services such as reference services, user education, circulation services, selective dissemination of information among others are offered to their users. Notwithstanding this and the enormous increasing usage of mobile devices among students on university campuses (Dadzie, 2009), the libraries are yet to implement m-tech based library services or make any of their services available on m-tech platforms. Several studies have been done on the use of m-tech's in academic libraries globally. Examples include (Jaradat, 2012; Lui & Briggs, 2015 ; Saravani & Haddow, 2015, Hamad, Farajat & Hamarsha, 2018). In the African context, some studies have been conducted on m-tech applications in libraries. Notable among them are (Paul and Mavuso, 2012; Sekyere, 2011; Baro, Efe & Oyeniran, 2014; Mohammed, 2014; De Wee, 2015; Chaputula & Mutula, 2018). There is, however, a lack of remarkable research that has ascertained how m-tech based library services can be adopted and implemented in academic libraries in Ghana. In addition, the researchers are yet to identify any research work that seeks to examine the views of graduate students', library management and library IT staff to ascertained their views on the potentials of adopting and implementing m-tech based library services in Ghanaian academic libraries. The lack of research in this field in Ghana has created a knowledge gap. Accordingly, this study is timely and aims to fill this specific knowledge gap. This study, therefore, sought to ascertain how m-tech based library services can be adopted and implemented in Academic Libraries in Ghana.

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II. THEORETICAL FRAMEWORK

The researchers relied on the Technology Acceptance Model (TAM) as the theoretical framework for this study. Technology Acceptance Model is a model founded by Fred Davis in 1989. This model is used to assess people's acceptance and usage or acceptance and implementation of any technology in an institution. It determines the factors that make an individual or institution to either accept or reject an emerging technology and use. According to Davis (1989), these factors are the perceived usefulness of the technology and perceived ease of use of the technology. He further explained the perceived usefulness of technology to mean the level of belief that one that the use of a particular technology will increase or improve one's performance of work.
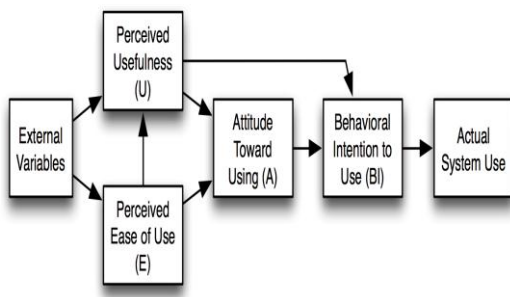
Source: "Technology Acceptance Model (TAM) (Davis, 1989)

In other words, technology is useful in meeting the needs of the user. The perceived ease of use of technology, on the other hand, meant the level of belief that one has such that the usage of a particular technology is easy to use. Thus for an individual or institution to actually use or reject a particular technology they will have to form a behavioural intention. This intent is influenced by their attitudes that is what they think about the technology, basically their general impression about the technology. The factors that form the bases of individuals' or institutions' attitude to use a particular technology are the perceived usefulness of the technology and perceived ease of use of the technology and that is the central premise of the TAM. This model is adopted by the researchers for this study because for academic libraries to be relevant in today's information world, it must employ and use modern ICT technologies in the provision of its services for client satisfaction. Thus, a particular technology to be adopted will be determined by the perceived usefulness and perceived ease of use of the technology by both library staff and library users.

III. LITERATURE REVIEW

A. The Concept of ICT

Information and Communication Technology highlights the importance of communication in data handling. It elaborates on how technology is employed to access and disseminate information. ICT merges information technology (IT) to provide easy and timely access to information through several communication technologies such as wireless networks, cell phones, internet, and audio/video conferencing (Tamilsel, Sivakumar & Sevukan, 2012). In the broader sense ICT embraces all aspects of computing technology. Aina, Okunnu, & Dapo-Asaju (2014) have defined ICT from a different perspective. However, all the definitions have some common grounds which have to do with using technologies in accessing, manipulating and communicating data. For instance, Oluwaronbi (2012) postulated that ICT is any electronic-based technology generally used to retrieve, store, process and package information as well as provide access to knowledge. Thus ICT involves the "use and application of telecommunications and computers in the acquisition, storage, retrieval, and dissemination of information to a wider and dispersed audience" (Aina, et al. 2014). From the above definition ICT resources are not only limited to computers but include telecommunication equipment.

Mobile Devices

Mobile devices are internet-enabled portable devices that aid in the processing, storage, and retrieval of information just like desktop computers (Khaddage & Latteman, 2013). They have in-built functionalities and features that mediate information access. According to Valk, Rashid, & Elder (2010) and Walsh (2012), they comprise mobility devices such as smartphones, e-book readers, Personal Digital Assistants, MP3 players, cell phones and tablets. Mobile devices' functionalities have become versatile, allowing people to use them for communication purposes and to access simple and too complex forms of information. Ferry (2009); Barnhart & Pierce (2012), also shared the view that modern mobile devices are handy, internet-enabled and can be used to access web-based content and re-edit the accessed information and share on a collaborative platform.

To Moreira, Ferreira, Santos, & Durao (2017), mobile devices are user-friendly, portable, adaptable and individuals can customize their usage to derive the full benefits from them. They are broad-spectrum computing devices with multi-core processors that come in handy with internet inbuilt features and can be used for several communication purposes.

B. Concept of mobile technology

According to Hamad, Farajat, & Hamarsha (2018), m-tech's are handheld information (IT) objects that encompass hardware (devices), software (interface and applications) and communication (network services). It can also be defined as technology that uses radio frequency spectrum in any band to facilitate the transmission of text data, voice, video, or multimedia services to mobile devices with freedom of time and location limitation (Kim, Mims & Holmes, 2006). Thus, they include mobile phones, portable digital assistants and integrated wireless solutions (Jarvenpaa & Land, 2005; Roy, Das, & Majumdar, 2016). We are in the digital era and this technological age is characterized by "personal and technical mobility". There is the evolution of mobile devices such as mobile phones, MP3 players, tablets, PDAs. This evolution, coupled with seemly growing wireless internet connections and the embracement of universal swift-speed mobile broadband makes m-tech a critical innovation if organizations/institutions are to meet the needs of their customers/users.M-tech's have changed the way people communicate.

M-tech's augment the way people access, receive and interact with information, and they provide new channels for collaboration and communication (Hamat, Farajat & Hamarsha, 2018). To Hamat et al (2018), these new technological advancements provide faster access to an increasing volume and variety of information. Sabah (2016) opined that m-tech (specifically cell phones and tablets) has already proven effective in all aspects of daily life. Users are increasingly relying on mobile devices as the most important means of performing many daily activities such as web navigation, e-mail access, reading books and social media engagements with friends. M-tech's provides easy to use technologies and immediate access to vital information. It is considered a contemporary technology with enormous benefits to individuals, educational institutions, corporate organizations, and government agencies. Mobile devices provide a transportable way to access data across borders, areas, and institutions (Singh-Negi, 2014). M-tech's provides a mobility central interface for individuals to access and share information anywhere anytime (Saxena & Yadav, 2013; Singh-Negi, 2014).

People progressively want to accomplish daily activities easily and rapidly by means of mobile devices and indeed m-tech's are changing society through how people create, share information and collaborate with one another (Wasserman, 2010; West & Ei, 2014). Although m-tech is an emerging technology, because of its vast benefits, technology experts and stakeholders are utilizing their applications in their various workplaces (West & Ei, 2014). Oblinger, Oblinger, & Lippincott (2005) asserted that key projects in several areas have indicated how m-tech is capable of molding and empowering people, advance change and promote the development of 21st-century skills. The success of m-tech and its numerous accompanied applications can be attributed to the astonishing growth in mobile devices, the growth in mobile broadband internet connections (Domingo & Gargante, 2016).

C. Mobile technology applications in academic libraries

M-tech's have greatly transformed how people interact and access information. As m-tech grows speedily, several students are utilizing mobile devices for academic objectives. An inquiry carried out by ECAR discovered that the statistics of students on university campuses adopting internet-enabled mobile devices has increased from 51.2% in 2009 to 62.7% in 2010 (Smith, Salaway & Borreson Carasu, 2009; Smith & Caruso, 2010). Therefore the popularity of m-tech is compelling libraries to review their service delivery approach to serve a lot of patrons who prefer to access library services on their mobile devices (Carney, Koufogiannakis, & Ryan, 2004; Cummings, Merrill, & Borrelli, 2010). Again Nowlan (2013) emphasized that academic libraries have to diversify their services to be in line with the revolutions in the computing world especially in the area of m-tech. The integration of m-tech in academic libraries operations permits users to access the resources of the library and make enquires remotely without physically being present at the library (Cummings, Merrill & Borrelli, 2010).

Griffey (2010) postulated that as more students make use of the internet on their mobile devices especially using their smartphones as compared to conventional PC, academic libraries should acknowledge the benefits of m-tech and provide services through such medium to meet users' needs. In 2009, the Association of Research Libraries anticipated that ubiquitous presence of WiFi, handheld communication devices, smartphones, among others will spur libraries to re-tool content for mobile users and mobile devices (Lowry, 2009). Murphy (2011) mentioned that academic libraries are advancing mobile contents and solutions in this information age in order to meet the needs of students and researchers who are complacent with the use of m-tech for rigorous research. M-tech applications help libraries to design modern and stimulating services to patrons who use mobile internet-enabled devices. They provide the prospect for academic libraries to improve their traditional library services through mobile collections and databases, mobile catalogues, mobile SMS services, mobile library instructions and virtual tours (Hahn, 2008).

In the Ghanaian context, m-tech based library services are yet to receive recognition. This is largely due to the fact that development in terms of new technologies has always been a problem in developing countries. Kamba (2011) in his studies in Africa revealed that 85% of the libraries offer less than one PC for every hundred (100) library users. About 15% of them are not linked to computers and the internet at all. Technologies are not fully exploited to realize the maximum benefits on university campuses in Ghana (Armah, 2009).

D. Mobile technology-based library services

Libraries have extensively embraced the concept of mobile devices applications to provide numerous innovative services to meet the needs of their users (West, Hafner & Faust, 2006). Mobile devices include smartphones', iPods, PDAs, tablets computers, e-book readers that are portable and have internet-enabled functionalities in them. Lippincott, Smith, Jacobs, & Lippincott (2010) postulated that mobile devices and their accompanied applications allow library patrons to access digital contents created by libraries in the palm of their hands.

According to Kurkovsky & Meesangnil (2012), the adoption and applications of m-tech to prioritize delivery of mobile content services is the new dimension in most information centres globally. A report published by ACRL in 2010 revealed that librarians are altering their services to make them accessible on mobile platforms (ACRL Research Planning & Review Committee, 2010). Academic libraries are developing mobile library applications to provide expedient and suitable means for patrons to interact with their services. Now, with mobile library technologies, patrons can search for a library's catalogue, view upcoming events, make a reservation for library facilities, text for reference inquiries, and renewed borrowed materials. It must consequently be noted that m-tech based library services create the medium for librarians to develop digital content for library users through the use of m-tech's. They are services that make use of smartphones and other mobile devices such as computer tablets;

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PDA's to present a novelty and opportunities for information centres to provide services for their remote users (McKiernan, 2010; Paterson & Low, 2011).

In the views of Choy & Goh (2016) and Hung & Chanlin (2015), m-tech based library services include mobile online public access catalogue (MOPAC), mobile e-journal, mobile databases, short messaging services (SMS) for reference services, mobile collections (e-books, audio materials), mobile digitized thesis, mobile library tour/instruction. A study by Mansouri & Soleymani (2019) revealed that the most contemporary services that users want to have on their mobile devices are mobile collections and databases, circulation and renewal services, mobile reference services (ask a librarian) and mobile library tour or instruction. In the global scene, different strategies are adopted by top universities libraries to offer m-tech based library services (Pakdaman, Sharif, Ziaei & Ghaebi, 2018).

Despite the varied strategies, Dukic, Chiu & Lo (2015), in their study in Hong Kong & Japan recommended that for libraries to offer services on m-tech platforms, they need to critically explore the exact information needs of their patrons. Research in Africa with regards to m-tech based library services in academic libraries does not depict a very good image. Several academic libraries in Africa are not utilizing the benefits of m-tech in their information delivery. M-tech adoption and implementation are crucial for the advancement of the services of academic libraries in the 21st century which is characterized by the digital information age, proliferation in mobile internet, and mobile devices and users' preference for boundary-less access to information. Academic libraries in Africa should, therefore, deploy more investments in the development of m-tech based library services.

IV. METHODOLOGY

The study employed a descriptive survey. According to Cooper & Schinder (2011), descriptive surveys depend on direct contact with those persons or a sample of those whose characteristics, behaviours or attitudes are relevant to a specific investigation. The choice for the descriptive survey was influenced by the fact that the researchers were dealing with a large population who were remotely dispersed across the campuses of the selected public universities. Thus, using the descriptive survey enabled the researchers to collect data from the large population at a relatively cheaper cost.

The approach for this study was the mixed method in collecting quantitative data (using questionnaires) and qualitative data (using interviews) from the respondents. The researchers used the mixed method approach because using this approach helps in building the strengths of using both quantitative and qualitative data for the study (Cresswell, 2015).

The general population for this study comprised all the categories (public universities, private universities, technical universities) in Ghana. Out of these, the researchers purposively selected 408 respondents comprising 380 students and 28 library staff across the universities and academic libraries in Ghana. The choice of the students is due to the fact that they are the beneficiaries and patrons of the libraries and the services rendered by the libraries. Since the library staff are the service renders and providers, it is prudent for the researchers to select them to serve as respondents for the study. The purposive sampling technique was adopted due to the unique characteristic of the respondents and enabled the respondents to answer to the questions. It enabled the researchers to reach the targeted sample quickly and since proportionality is not the main concern. The questionnaire and structured interview were used to collect data for this study. The researchers used both quantitative and qualitative data collection instruments because of the kind of information the researchers wanted to gather for the study. The data that was collected was first edited to correct errors. It was then collated, coded and analyzed descriptively using the Statistical Package for the Social Sciences (SPSS) version 22.0 into frequencies and percentages. The data that were generated through the questionnaire were assigned with appropriate codes and analyzed. The results were presented in the form of tables, pie charts and bar charts showing frequencies and percentages of responses given by the respondents.

V. PRESENTATION OF DATA AND ANALYSIS

Out of the 408 questionnaires distributed, the researchers were able to retrieve 356 fully completed questionnaires. This represents an 87.25% response rate.

1. Awareness that mobile devices can be used to access library services in universities

The researchers first sought to find out whether respondents were aware that mobile devices could be used to access library services in universities as a way to assess the level of awareness and appreciation for the use of m-tech based library services.

Table 1: Awareness and use of m-tech based library services

Awareness and use of m-tech based library services	S-D	D	N	A	S-A	Total
Awareness that mobile devices can be used to access library services	17 4.8%	22 6.2%	20 5.6%	140 39.3%	157 44.1%	356 100%
Subscribing to Library Services if offered on M-Tech Platforms	3 0.8%	5 1.4%	20 5.6%	146 41%	182 51.2%	356 100%
Introducing M-Tech library service to friends	8 2.3%	14 3.9%	36 10.1%	182 51.1%	116 32.6%	356 100%
Accessing M-Tech Library Service from many Mobile devices	7 1.9%	13 3.7%	33 9.3%	166 46.6%	137 38.5%	356 100%
Using M-Tech library services because it has no physical Restrictions	8 2.3%	14 3.9%	26 7.3%	147 41.3%	161 45.2%	356 100%

Source: Field data, 2019

A.1. Awareness that mobile devices can be used to access library services

The study shows that 157(44.1%) out of the 356 respondents strongly agreed that they were aware that mobile devices could be used to access library services in universities, 140 (39.3%) agreed that they were aware that mobile devices can be used to access library services. Twenty 22 (6.2%) disagreed and 17(4.8%) strongly disagreed. Twenty (5.6%) were neutral that they were aware that mobile devices could be used to access library services in universities. This implies that the majority of respondents from both universities were aware that mobile devices could be used to access library services in universities. Further analyses made to probe deeper into the level of awareness and appreciation for m-tech based library services showed a deep appreciation for such services by students. These results resonate with the findings of Washburn (2011), Saravani and Haddow (2011), and Hamad et al (2018) who reported that there is a high level of awareness of MT library services among library staff and patrons.

A.2. Subscribing to library services if they are offered on mobile technology platforms

The findings on whether respondents would subscribe to library services if they are offered on mobile on m-tech platforms indicate that 182 (51.2%) of the respondents strongly agreed that they would subscribe to library services if they are offered on m-tech platforms, 146 (41.0%) agreed, 20 (5.6) were neutral, 5 (1.4%) disagreed and 3 (0.8%) strongly disagreed. The findings show that 328 (92.2%) of the respondents would appreciate and use m-tech based library services if they are implemented by the academic libraries.

A.3. Introducing mobile technology-based library services to friends

The analysis of data from the field indicates that the majority (182: 51.1%) of the respondents agreed that they would introduce m-tech library services to their friends, followed by 116 (32.6%) who strongly agreed to the statement. However, 14 (3.9%) and 8 (2.3%) of the total respondents disagreed and strongly disagreed respectively that they would like to introduce m-tech library services to their friends.

A.4. Mobile technology enabling library service to be accessed from many mobile devices

Deducing from the Table, it was clear that majority of respondents agreed that they would like m-tech in their library because a single library resource/service can be accessed from many mobile devices as 166 (46.6%) of the respondents agreed and 137(38.5%) respondents strongly agreed from the two universities. However, 13 (3.7%) and 7 (1.9%) of the 356 sampled respondents disagreed and strongly disagreed that they would like m-tech in their library because a single library resource/service can be accessed from many mobile devices. Thirty-three 33 (9.3%)

M-Tech based websites and apps make libraries more interactive	7 1.9%	15 4.2%	80 22.5%	132 37.1%	122 34.3%	356 100%

of the respondents were neutral. These results resonate with studies by Lippincott (2009); Goh (2011), and Smith et al. (2010) who opined that mobile reference inquiry services were extensively in the known to most of the students and they preferred to use the services to get reference assistance from the librarians.

A.5. Appreciating m-tech based library services because it has no geographical restrictions

In connection with respondents' appreciation and use of m-tech library services because it has no geographical restrictions, 161 (45.2%) of the respondents from the universities strongly agreed that they would appreciate m-tech library services because it has no geographical restrictions, 147 (41.3%) respondents from the universities agreed that they would appreciate m-tech library services because it has no geographical restrictions. These findings are similar to the results of the studies of Karim, Darus, & Hussin (2006); Washburn (2011), and Dresselhaus & Shrode (2012). These authors argued that library patrons, particularly students, were subscribing to m-tech based library services and they appreciate the use of it. They stated that library patrons have the conviction that the m-tech provides them with boundary-less access to library services, afford them the opportunity to have interactive services and be able to access a single library resource/service with varied mobile devices.

A.6. M-tech based websites and apps makes university libraries more interactive

Respondents were asked to indicate their agreement or disagreement that, through designing m-tech website and app, their university library makes its services more interactive by adding chat sessions, blogs, and social interfaces. The results show that a total average of 254 (71.4%) respondents from the universities agreed that through designing m-tech website and app, their university library will make its services more interactive, with 122 (34.3%) and 132 (37.1%) responding " strongly agreed" and "agreed" respectively. These findings are in agreement with the results of the study by Saravani & Haddow (2011), Chaputula & Mutula (2018) and Shonhe (2019) which revealed that the design and use of m-tech based systems make libraries more attractive and interactive users have a positive attitude towards technology adoption.

B. Type of mobile device owned by student respondents

Mobile devices comprise handheld tablets, smartphones, iPod, cell phones, PDA's and e-book readers. The researchers, therefore, sought from the respondents, the type of mobile devices owned by them and whether they had internet access on their mobile devices.

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The findings on the type of mobile devices owned by respondents and whether they had internet access on them are presented in Table 2

Table 2: Type of mobile device owned by respondents with internet access

Mobile device	N	Frequency	Percent
Smart phones	356	335	94
Tablet	356	102	29
Regular cell phone	356	100	28
Personal Digital Assistant (PDA's)	356	58	16
E-Book Reader	356	52	15
IPod	356	33	9

internet access on their mobile device	N	Frequency	Percent
YES	356	351	98.6
NO	356	4	1.4

Source: Field data, 2019

The results as can be seen from Table **** show the type of mobile device owned by respondents and the availability of internet access on them from both universities. It is interesting to note that from multiple responses, 335 (94.0%) of the student respondents from the two universities own smartphones, 102 (29%) have tablet, those with regular cell phone were 100 (28%), personal digital assistant ownership rate stood at 58 (16%) and the number of students with e-book readers and IPods was 52 (15%) and 33 (9%) respectively. It is evident from the findings that the majority of the respondents own more than one mobile device. Again, an inquiry was made to ascertain whether respondents had internet access on their mobile devices. The analysis revealed that out of the total number of 356 student respondents who were used for the study, 351 (98.6%) had internet access on their mobile devices with only 5 (1.4%) of them indicating that they did not have internet access on their mobile devices. This indicates that the use of mobile devices to access the internet was very common among students. The findings corroborate with literature which noted that major academic libraries in China had designed a mobile interface that allows library users to use mobile devices to access their digitized institutional repository and browse through the library's academic databases and e-journals (Li, 2013).

C. Reasons students use mobile devices in school

Respondents were asked to indicate the reasons why they used mobile devices in school and the results are summarized in Table 3 below:

Table 3 Reasons students use mobile devices in school.

Reasons for Using Mobile device	N	Frequency	Percent
Because of educational purpose	356	213	59.8
Because of needs	356	145	40.7
Because mobile device is popular	356	67	18.8
Because of curiosity	356	43	12.1
Other	356	42	11.8

Source: Field data, 2019

The results showed that 213 (59.8%) indicated that they used mobile devices for educational purposes, 145 (40.7%) used them because of needs.

Sixty-seven (18.8%) revealed that they used mobile devices because mobile devices were popular, 43 (12.1%) used mobile devices because of curiosity and 42 (11.8%) indicated that they used them because of other reasons.

It is clear from the findings that the majority of the respondents used mobile devices because of educational needs. The revelation confirms the study results of Pu, Chu, Chen and Huang (2009), that students have a positive desire to use m-tech library services and they are enthusiastic in using them at anywhere and anytime and because they are user-friendly.

A study by Wu, Chatfield, Hughes, Kysh & Rosenbloom (2014) on students' willingness to access library services on the m-tech platform, found out that almost all respondents had the desire to use their smartphones and tablets to access such services because to them mobile internet is cheap. Joo and Choi (2015) also reported that library users will prefer to access library resources via online and specifically on their mobile devices when the system that drives such services is user-friendly and interactive.

D. Library services that can be delivered via Mobile Technology Platforms

One of the objectives of the study was to identify library services that can be delivered on m-tech platforms at the selected libraries. With choices of MOPAC (mobile online public access catalogue), book reservations and renewal services, mobile e-books collections, mobile library text messages or short SMS and email services, mobile e-journal and databases, mobile reference services, study room reservations, social networking services, mobile audiovisual materials, mobile digitized theses and dissertations, mobile alerts on list of new library materials arrivals and mobile library instructional guides and virtual tours, respondents were asked to indicate if they would be interested in these services to be delivered on m-tech platforms or they would not be interested.

Source: Field data, 2019

From Table 3, 280 (78.7%) of the respondents indicated that they would be interested in accessing their library's catalogue on their mobile devices as against 76 (21.3) who indicated that they would not be interested.

On the whole, more than half of the respondents revealed that they would be interested in using their mobile devices to access the library catalogue if they are provided by the library. The findings concur with the assertions by Canuel and Crichton (2011) that librarians in Canada provide mobile forms of their OPAC. Paterson and Law (2011), and Cummings, Merril, and Borrelli (2010) also reported in their studies that 60% of students at Edinburgh University in the UK and 58.4 % at Washington State University, USA prefer accessing the OPAC using their mobile devices.

The results in Table 3 again disclosed that a significant majority of 301 (84.6) students respondents indicated that they would be interested in m-tech based library reference inquiry services. However, 55 (15.4%) respondents took a divergent position and indicated that they would not be interested in that service. These results resonate with studies by Lippincott (2009); Goh (2011), and Smith, et al (2010) who opined that mobile reference inquiry services were extensively in the known to most of the students and they preferred to use the services to get reference assistance from the librarians.

On mobile e-books collection, 309 (86.8%) of the respondents from the two universities indicated that they would be interested in mobile e-books collections if they are offered on m-tech platforms by their respective university

Library services that can be delivered via M-tech Platforms	Interested	Not Interested	Total
Mobile Online Public Access Catalogue (MOPAC)	280	76	356
	-78.70%	-21.30%	-100%
Mobile Reference Enquiry services (including live chat with librarians remotely for assistance)	301	55	356
	-84.60%	-15.40%	-100%
Mobile Electronic Books Collections	309	47	356
	-86.80%	-13.20%	-100%
Mobile academic databases/ e-journals	327	29	356
	-91.90%	-8.10%	-100%
Mobile Digitized project/dissertation/thesis	312	44	356
	-87.60%	-12.40%	-100%
Book reservations /Renew Borrowed library books	258	98	356
	-72.50%	-27.50%	-100%
Mobile Library Instructional Guides and Virtual Tours	274	82	356
	-77%	-23%	-100%

libraries. Surprisingly, out of the total number of 356 students who were used for the study, just 47 (13.2%) took a different position and declared that they would not be interested in mobile e-books collection if they are offered on m-tech platforms. On the total average, the majority of the respondents indicated that they would be interested in mobile e-books if they are to be delivered on mobile platforms by their universities.

An increasing number of publishers and academic libraries are designing mobile versions of their

web pages and creating digital contents of collections that can be accessed on mobile devices platforms on the go. Through the study, the research established that 327 (91.9%) of the respondents from both universities responded that they would be interested in mobile versions of academic databases and e-journals whilst 29 (2.9%) revealed that they would not be interested in a service of that nature. Cumulatively, it was noticeable that a large segment of the student respondents were interested in having mobile versions of academic databases and e-journals provided by their libraries.

Also, academic libraries allow their users to have access to their institutional repository contents such as thesis, dissertations, and projects works. The analysis shows that when it comes to mobile digitized thesis and dissertations, 312 (87.6%) of the respondents were interested and would want their university library to provide the service on m-tech platforms, as compared to 44 (12.4%) who were not interested. The findings substantiate the view of Li (2013) that mobile devices facilitate access to academic databases and e-journals.

With regard to book preservation and renewal, 258 (72.5%) of the respondents expressed that they would be interested in using their mobile devices and m-tech in making book reservations and renewing borrowed books from their libraries if the service is provided by their library.

It was clear from the analysis that the majority of the student respondents expressed interest in an m-tech library service that would enable them to remotely borrow and renew library materials.

In addition, mobile library virtual tour and instructions are new innovative ways of guiding remote users to effectively appreciate and use the resources and services of a library. 274 (77.0%) respondents indicated that they would be interested in mobile library instructional guides and virtual tour, while 82 (23.0%) out of the 356 revealed that they would not be interested in that service. Tenopir (2009); Kroski (2008); Jowitt (2008); and Murray (2010) identified in their study that libraries provide videos and audio MP3 files of library instructions and virtual tours that can be accessed with mobile devices via YouTube and iTunes channels and over 71.1% of the respondents were in support of this service.

E. Challenges associated with the adoption and implementation of m-tech based library services

The study again sought to identify potential challenges that may impede the adoption and implementation of m-tech based library services in Ghanaian academic libraries. On total average, a large percentage of the respondents agreed to the following as challenges that may obstruct the adoption and implementation of m-tech based library services. These include the following:

1. Lack of policy framework for the adoption of the technology
2. Clearing the hurdle of University management accepting to adopt the technology since this requires huge capital outlays
3. Bureaucratic process dragging or derailing implementation after a decision to adopt
4. Lack of requisite skills on the part of library staff
5. Financial constraints
6. Poor or inadequate internet bandwidth
7. Issue of sustainability
8. Lack of IT infrastructure
9. Unreliable power supply and intermittent power outages
10. Lack of appreciation for the technology among library staff

These challenges corroborate the findings identified by studies in other academic libraries such as Amekuedee (2005), Saxena & Dubey (2014), Haneefa (2007), Aina, Okunnu, & Dapo-Asaju (2014), Chisenga (2015), Ghuloum and Ahmed (2011), and Chaputula & Mutula (2018). For example, Amekuedee (2005); Saxena and Dubey (2014) identified the lack of support from University management as a major constraint for the integration of ICT and mobile technologies in academic libraries. Haneefa (2007); Iwhiwhu, Ruteyan & Eghwubare (2010); Aina, Okunnu, and Dapo-Asaju (2014), and Chisenga (2015) found out that, lack of finances have constrained the adoption of m-tech based library services in academic libraries. Studies by Mulimila (2000); Suku and Pillai (2005); Haneefa (2007);

Ghuloum and Ahmed (2011), and Hamad et al (2018) found that staff of academic libraries often do not possess the right kind of ICT skills needed for the smooth deployment of emerging technologies.

VI. CONCLUSION

This research sought to ascertain the adoption and implementation of m-tech Library Services in Ghanaian academic libraries. The findings of the study established that there is a strong awareness and appreciation of m-tech based library services among the students and library staff. On the library services that can be delivered on mobile platforms, the respondents were interested in mobile e-journals and academic databases, mobile digitized local institutional repositories, mobile reference inquiry services, mobile online public access catalogue (MOPAC) and mobile electronic books collection. Other services preferred include SMS alert for new arrivals, mobile library instructional and virtual tours and mobile social-media services. This study has also led to the uncovering of the potential challenges that can obstruct the successful implementation of m-tech based library services in Ghanaian academic libraries. When the challenges identified in the findings are properly addressed, they may be used as the foundation for the successful implementation of m-tech in academic libraries in Ghana.

VII. RECOMMENDATIONS

Based on the findings and outcomes drawn, the following recommendations are put forward by the researchers for the successful adoption and implementation of m-tech based library services in academic libraries in Ghana.

1. Invest and deploy ICT infrastructure to aid them-tech based library services
2. The management of the libraries should train the librarians on the role and use of mobile devices and m-tech adoption and use in libraries. This will enable them to fully appreciate and support the deployment of m-tech in the libraries
3. The library patrons also need some form of training on the role and use of m-tech to access library materials
4. Develop policy framework for the adoption of the technology in academic libraries
5. The management of the universities and libraries should identify and provide adequate funds to aid the full realization of the technology deployment in the academic libraries.
6. Improvement of internet bandwidth in the libraries and the university campuses to facilitate the use of mobile devices to access the open-access materials (e-books, databases, e-journals, etc.)
7. Unreliable power supply and intermittent power outages

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