



**EXTENDING THE TECHNOLOGY ACCEPTANCE MODEL TO PREDICT
MOBILE LEARNING ADOPTION AMONG TERTIARY EDUCATION
STUDENTS IN BOTSWANA**

By

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A Dissertation Submitted to the College of Science in Partial Fulfilment of the
Requirements for the Award of the Degree of Master of Science in Information Systems of
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CERTIFICATION

The undersigned certifies that she has read and hereby recommends for acceptance by the College of Science a dissertation titled: **EXTENDING THE TECHNOLOGY ACCEPTANCE MODEL TO PREDICT MOBILE LEARNING ADOPTION AMONG TERTIARY EDUCATION STUDENTS IN BOTSWANA**, in fulfilment of the requirements for the degree of Master of Science in Information Systems of the BIUST.

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ACKNOWLEDGEMENTS

Firstly, I wish to thank my supervisor Dr. Malatsi Galani for his continuous support throughout my MSc and research, his patience, motivation and immense knowledge in Information Systems. His guidance throughout the research and thesis writing is highly appreciated. I could not have imagined having a better and supportive supervisor for MSc study.

I am deeply grateful to my cousin Dr. Reginald Oats, who encouraged me to apply for MSc study in BIUST and whose high expectations challenged me throughout my study.

I am grateful for my parents Rev and Mrs. Kapeko for their constant support, love, and motivation throughout my studies. The Lord shall increase you more and more, you and your children, Psalm 115:14.

Special thanks go to my lovely sisters, Tjinono and Sophia Kapeko, whose guidance and support made me consider a career in ICT.

To my only brother Rehongee Kapeko, who gave me years of fun throughout my lifetime. Whose love, hope, and trust in me made me succeed in every endeavor I pursue, thank you.

To my colleagues Kushatha Ntwaetsile, Uzapi Hange, Neo Rafifing, and classmates, it has been my pleasure working with you.

To my special friends Nametso Titus, Setlankana Rukamba and Kutlo Tlhako whose love and encouragement uplifted my soul during tough times, thank you.

This study would not have been possible without the financial assistance from BIUST, I owe an eternal gratitude.

Lastly, To God be the Glory.

DEDICATION

To my beloved parents Rev and Mrs. Watondwa Kapeko, my keen sisters Tjinono Kapeko and Sophia Kapeko and lovely brother Rehongee Kapeko.

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LIST OF ABBREVIATIONS

A	Attitude
BI	Behavioral Intention
TAM	Technology Acceptance Model
TEI	Tertiary Education Institution
PEOU	Perceived Ease Of Use
PU	Perceived Usefulness

ABSTRACT

A new paradigm shift from eLearning to mLearning will inevitably change the learning process. There is an immense proliferation of mobile technologies however in education these technologies are not fully utilised. Thus the key question that arises is that what are the factors which influence students to adopt mobile technologies in education? The purpose of the study is to extend and apply Technology Acceptance Model (TAM) as the theoretical framework to explain the determinants of mLearning adoption among tertiary education students in Botswana.

TAM is the most influential theory used to study the adoption of information systems. However, TAM has been criticised that it accounts for only 40% of the variance in intention to use. The study introduces mobile readiness, perceived mobility value, perceived privacy and perceived trust as external variables that reflect the student's belief in mobile learning adoption. The findings provide an in-depth knowledge derived from a theoretical model that assists in the successful adoption of mLearning. The study employed a mixed method strategy. Qualitative data was collected through group interviews followed by Quantitative data collected through a questionnaire. The empirical part of this study was conducted in July 2016. Four tertiary institutions were selected for this investigation.

It was concluded that perceived trust, mobile readiness, perceived privacy and perceived mobility value are crucial factors influencing students to adopt mLearning technologies. The findings support the view that attitude and perceived usefulness are the key determinants of mLearning adoption. The findings imply that it is vital to sensitize students on the usefulness of these mLearning technologies before actual adoption as it helps to develop a positive attitude among the students. Future work should work on building a mLearning theory that encompasses all the dimensions of mLearning. The use of data mining tools should also be used to uncover complex patterns on the data.

Keywords: *adoption, mLearning, TAM, tertiary education*

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

The spread of mobile technologies has led to a profound change in the way education is delivered. Nowadays, learning is no longer associated only with traditional classroom environments but can be experienced anywhere and anytime through mobile technologies. Traditionally, the physical presence of students in classrooms in tertiary education institutions (TEI) was mandatory but with the advent of mobile technologies, the norm is slowly changing. Mobile technologies are promising to be suitable modes of learning, giving rise to the emergence of mobile learning widely known as mLearning. Mobile learning refers to a form of teaching and learning that occurs through mobile devices taking advantage of affordability and portability [1].

Mobile learning offers wide-ranging benefits to learning. For instance, mLearning offers flexible and personalised learning approaches and as such students can learn anywhere and at any time. The approaches may be of high value to students, especially tertiary education students (TES). To date, considerable research on mLearning indicates that students prefer the flexibility of using mobile devices [2]. The mLearning approaches are engaging to learners, shifting away from traditional passive learning to a more active learning approach. The future of mLearning looks promising. However, the key question is, “What are the factors which influence students to adapt mLearning technologies?” [3] [4]. Mobile technologies will have a significant and promising role in education [5]. Furthermore, it is argued, “Mobile technologies will be the future of education whether one likes it or not: future generations of learner will demand that education should be delivered on mobile technologies” [5]

However, Alturki [1] contends that students believe that these devices are meant only for entertainment and recreation, which complicates the potential behind mLearning. With such contradictory views, it is difficult to conclude on the readiness of mlearning among TES in Sub-Saharan Africa. Hence this systematic research seeks to provide insights into the readiness of students towards mLearning.

Botswana has one of the highest mobile penetration rates in Africa [6]. Furthermore, Botswana's mobile cellular subscription per 100 people is 144, which is one of the highest in the world. This basically means that each person has more than one subscription. With the rapid growth of the utilization of mobile devices, a shift from eLearning to mLearning may be a welcome development in Botswana. Therefore with this high mobile penetration rates, it is important to explore the application of mobile technologies in the learning process. However, it has to be noted that although Botswana have high mobile penetration rates, this does not alone guarantee readiness to integrate mobile technologies in learning. Also limited knowledge exists on theoretical aspects of mLearning in an African context.

1.2 STATEMENT OF THE PROBLEM

The problem this study addresses is that there is an immense proliferation of mobile technology however in education these applications are not fully utilized. Almasri [7] emphasised on the need to examine factors that influence adoption of mLearning in developing countries because the successful adoption of mLearning in one country does not necessarily apply to other countries due to the context variances. Thus there is a need to assess factors which influence students to adopt mLearning, which is a dilemma faced by many TEI [8] [9]. According to Khanh et al. [10] TAM is regarded as the most robust and widely used theory in Information Systems to predict adoption of technology. However, TAM has been largely criticised by a number of scholars that it is not able to explain as much of the variance in user behavioral intention to use and actual use, emphasising that it can only account for 40% of the variance [11] [12]. Therefore considering unique characteristics of mLearning the predictive power of TAM can be improved.

1.3 GENERAL OBJECTIVE

- To extend and apply TAM as a theoretical framework to predict the determinants of mLearning adoption among Tertiary Education Students (TES).

1.4 SPECIFIC OBJECTIVE

- To analyze key determinants of mLearning adoption.
- To determine the level of readiness for mLearning among tertiary students in Botswana.
- To develop a predictive model for mLearning adoption in Botswana.
- To validate the model by providing psychometric evidence of measurement scales.

1.5 RESEARCH QUESTIONS

- What is the level of mLearning readiness among tertiary students in Botswana?
- What are the factors which influence mLearning adoption in Botswana?
- What are the relationships among external variables, key determinants, attitude towards using and intention to adopt mLearning?
- Which factors are most influential in predicting intention to use mLearning?
- What are the theoretical and practical implications of the research findings?

1.7 SIGNIFICANCE OF THE STUDY

The main outcome of the research is systematic and in-depth knowledge derived from a theoretical model that should assist in the successful adoption of mLearning for TEI in Botswana. Furthermore, this research significance is to advance TAM model by adding three external constructs which provide a better understanding of the adoption of mLearning as well as improving its predictive power by increasing its variance in user behavioral intention to use and actual use. This proposed model lays the foundation to identify key factors that need to be explored and considered before actual adoption.

The research findings are of interest to lecturers, University managers and policy makers who are responsible for the deployment of mLearning applications for use in tertiary education institutions in Botswana. It enables education policy designers to understand how mobile technologies can be explored to make it suitable for learning. Also, the findings will drive the strategies of TEI in Botswana to accommodate the demands of TES for suitable and relevant integration of mobile technologies in learning. Findings are also of interest to Information Systems scholars who are interested in adapting TAM for their studies.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The chapter provides a review of mLearning in tertiary institutions, students' readiness and their perceptions towards mLearning. It also discusses the theoretical TAM model used in the research and key issues related to TAM. The chapter also reviews extended TAM models specifically in education. Finally, it then provides a brief summary of the research gaps in existing literature.

2.2 MOBILE LEARNING

2.2.1 DEFINITIONS OF MOBILE LEARNING

Mobile learning is a new and evolving concept that has been defined differently by different authors. There is no consensus on the standard definition of mLearning. Most authors have defined mLearning based on their particular experiences, uses, and backgrounds [13]. The existing definitions are diverse and sometimes contradictory.

2.2.1.1 MOBILE LEARNING IN THE CONTEXT OF THE "MOBILITY" ASPECT

Song [14] reflected that most definitions are inclined to the mobility of the technology as opposed to other components. However, it was suggested that more emphasis should be on the mobility of learning [15]. Similarly, Ahmadi et al., [16] emphasises that more focus should be on the learning process and the learner. Mehdipour et al., [17] believes that mLearning is specifically designing learning experiences that exploit opportunities that mobility can offer.

Also, Hussin et al., [18] highlighted that the word "mobile" in mLearning refers mainly to the mode of learning such as a mobile phone or tablet which serves merely as a tool to enhance learning. Thus more focus should be on the learning itself not on the technology. However, ownership of a mobile device does not necessarily guarantee usage of it for educational purposes [18]. Traxler [19] believes that mLearning is a new and emerging concept. Therefore, it is unclear and has no definite explanation. Similarly, the concern of this research is that mLearning is a new concept hence little is known about its pedagogical implications. It is inevitable that the mobility of mLearning is an essential defining attribute of mLearning [20].

2.2.1.2 MOBILE LEARNING IN RELATION TO ELECTRONIC LEARNING

Peng et al. [21] stated that more often mLearning is mistaken as eLearning, as the terms are used in a complementary way. Mobile learning is not merely the conjunction of “mobile” and “learning” it means “mobile eLearning” [17]. It is a subset of eLearning. However, it is argued that mLearning is emerging as a new and distinct concept [20] [22] [14] [23]. Oller [22] highlighted that mLearning had shown a great potential to disrupt existing pedagogical infrastructure, including online education, this implies that eLearning and mLearning are totally distinct. Additionally, Traxler [23] believes that regarding mLearning as portable eLearning will ease its diffusion but slowly weaken its contribution. This means that regarding mLearning as eLearning will make it easy for mLearning to become known or recognised in academic literature but it will weaken its meaning since mLearning and eLearning are distinct concepts.

2.2.1.3 MOBILE LEARNING DEFINITION FRAMEWORK

The mLearning definition framework is based on the conclusions drawn by El-Hussein et al., [15] that mLearning makes more sense when the technology is fully mobile, and the users of the technology are mobile as they learn. Thus mLearning definition components are mainly mobility of technology, the mobility of learner and mobility of learning [15] [21]. The conclusion of El-Hussein et al. [15] on the definition of mLearning was adopted for the study because it consolidates all the angles of mLearning that is mobility of learner, technology and of the learning experience.

Learners are not a blank slate and do not learn in a vacuum; they learn by correcting the misconceptions they have from previous learning activities [24]. This implies that mobile experience as well forms the basis for defining mLearning. The definition thus derived from literature considers all the aspects of a variety of definitions which have been recommended by various mLearning studies reviewed. The components include mobility of technology, the mobility of learner, the mobility of learning and the mobile experience.

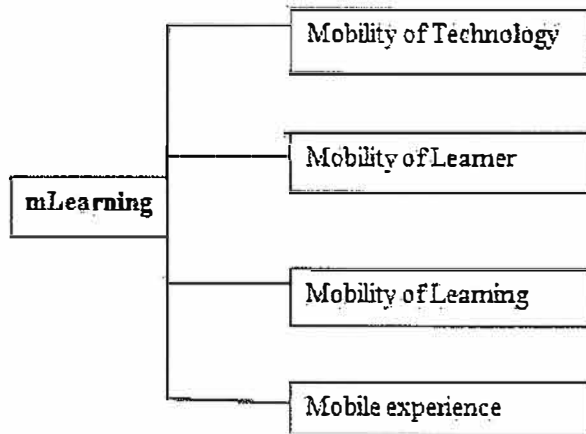


Figure 2:1 Mobile Learning Definition Framework

The mLearning definition framework above shows a graphical representation of the definition of mLearning adopted in this study. In this study, mLearning is regarded as the use of mobile technologies in the learning process whereby the learner is fully mobile (not in fixed locations to access content such as classrooms). A mobile technology is regarded as any device that allows a student to move from one place to another with the device. For example cell phone, tablet and other handheld devices.

2.2.2 MOBILE LEARNING READINESS

2.2.2.1 MOBILE PHONE OWNERSHIP READINESS

The majority of students in TEI have mobile devices which can be used to support mLearning. For instance, in Malaysia 100% of respondents indicated that they own a mobile phone [18]; as well as in Jordan in Amman University College [9]; and Polytechnic of Namibia [25]; in South Africa, mobile phone ownership stood at 98.2% [26]. Although ownership of a mobile device does not guarantee mLearning, the ownership of mobile devices amongst TES can be leveraged to support learning.

Mobile learning applications need to consider the requirements of mobile devices owned and used by students. For instance, in Namibia only 47.27% of respondents owned a mobile device with necessary requirements to support mLearning [25]. These indicates that some students will be excluded from mLearning particularly those who do not own mobile devices which support mLearning applications. However, Koch [26] claims that

readily available mobile capabilities such as SMS, Bluetooth, and photo camera have been used for mLearning with success in the past. Equally, it was found that smartphones offer supporting features required for pleasant user experience in mLearning [25]. This means that for efficient mLearning to occur a student need to own a mobile device which supports mLearning applications.

2.2.2.2 BUDGET READINESS

Budget readiness refers to the willingness or preparedness of students to spend extra money for mLearning [18]. For mLearning to occur, students have to incur some costs including the cost of the device, internet subscriptions, and maintenance costs. Students are unwilling to spend extra money for mLearning [27] [18]. It is evident that the majority of students can not afford data bundles for voice calling and text messaging [26]. Students were not satisfied with the cost tied to adoption of mLearning thus they were reserved when it came to financial issues. As a result, does this mean that mLearning is not feasible? It was recommended that a plan which leverages on high population of students and institutions be negotiated with service providers [27]. As drawn from the conclusion of Koch [26] readily available mobile applications such as SMS, photo camera, and Bluetooth can be targeted and leveraged to address the issue of incurring additional cost. It is evident that they have been used with success in the past. Perhaps cost cutting mechanisms could be employed to design programmes using non-paying mobile services [26].

2.2.2.3 PSYCHOLOGICAL READINESS

Psychological readiness is the perception of students towards mLearning. Students have a positive perception towards mLearning however perceived that blended learning which involves face to face should be maintained [18]. In Malaysia, students perceived that mLearning will save their learning time and are looking forward to integrating mobile devices for educational purposes [18]. According to Hussin et al. [18] students have a desire to take an mLearning assisted course provided that the materials are relevant to their learning needs. Also [28] in another study findings revealed that students are psychologically ready to adopt mobile technologies in learning as students have a positive perception towards mLearning. Majority of students indicated that mLearning is useful, as it makes possible to learn, meet learning needs and interest and gain feedback from lecturers more quickly than through traditional methods.

2.2.2.4 TECHNOLOGY READINESS

According to Koch [26] technology readiness refers to the capacity of a mobile device to run a required mLearning application and owners ability to afford data bundles or data subscriptions. For the purpose of this study, technology readiness refers to the student's ability to afford data bundles and subscriptions to use mobile application for learning purposes. Also, Koch [26] described mobile device ownership as the fundamental requirement for mLearning readiness. Conversely device ownership does not automatically guarantee mLearning readiness. In a similar study in Namibia [25], it was found that students are not ready to use mobile devices in learning mainly due to slow Wi-Fi on campus and inadequate infrastructure in the institution. Although a significant number of tertiary students indicate that they own mobile technologies it is not evident whether they are willing to use these mobile devices for learning purposes or not.

The link between Koch's work on the use of Short Message Service (SMS), photo camera and Bluetooth is closely linked to mLearning because the applications take advantage of the features provided by mobile technologies, hence these applications can be used to enhance the learning process. For example Moura and Carvalho [29] emphasised that SMS technology is one of the most powerful mobile technologies in current usage. As a result Moura and Carvalho [29] explored and explained how SMS based technology as a mobile application was used to teaching and learning languages. The findings of Moura and Carvalho [29] study proved that SMS based technologies can be used to improve or enhance the learning process of students. Also, an SMS application was integrated to the school's Learning Management System (LMS) whereby students received SMS from their lecturers in the form of quizzes, information and motivation [30]. As part of the LMS the students were also requested to respond to certain SMS' s as part of the course evaluation program [30]. Shih and Mills [31] also stated that texting, video recording, taking pictures or shooting videos are mobile activities that can be used to accomplish an educational goal. This basically means that mobile activities encompass all applications provided by mobile technologies such as SMS and Bluetooth as highlighted by Koch's [26] study.

2.2.3 MOBILE LEARNING BENEFITS AND CHALLENGES

Generally, mobile devices play a crucial role in improving the traditional teaching and learning approaches. Gikas and Grant [32] indicated that mLearning can diversify learning activities. This means that mLearning helps diversify the types of learning activities students are engaged in as it provides a variety of learning methods [32]. This helps in providing variety of learning activities to students as well as catering for students who are not catered by traditional learning activities. Thus students who were not catered for in existing learning activities may benefit from mLearning.

In numerous studies students indicated that mobile devices allowed quick access to course content anywhere and anytime [33] [7] [34] [32]. Ndilimeke and Nggada [25] argued that mLearning will not solve all the problems in education or address all the challenges in teaching and learning but will only extend the accessibility of teaching and learning materials. This is true, however the accessibility of course content anywhere and anytime will significantly improve the learning process of students. If students have the ability to access course material anywhere and anytime it will then indirectly promote continuous and situated learning [32].

Students also reported that mLearning enhances communication amongst students, and between students and instructors [32] [32]. They also indicated mLearning allows immediate feedback about course content and interaction with subject matter experts [32]. Similarly, Gikas and Grant [32] confirmed that mLearning fosters collaborative learning amongst students as they can discuss course content with classmates and instructors. Through collaborative learning students can then create new meaning and understanding thus improving their learning process.

Looking at these aforementioned benefits some institutions have provided mobile devices to their students to use in their day to day learning process. Institutions such as Duke University and Stanford School of Medicine have distributed mobile devices to their students to use for mLearning. However Keller [35] reported that students at Stanford stopped using their mobile devices in their courses a few weeks into the semester as they did not see the benefits of using them for learning purposes. These findings are consistent with what was suggested by Liu, Han and Li [36] that the adoption of mobile technology does not guarantee the adoption of mLearning. This was also emphasized by Seliaman and

Al-Turki [33] that the benefits gained from mobile devices depend on the intention of students to use them for educational purposes. This implies that if students do not have an intention to use mLearning then they would not adopt mLearning technologies.

Amidst these benefits it was reported by some authors that the features of mobile devices somehow inhibit their use for mLearning. Some technological restrictions also inhibit the adoption of mobile technologies for learning purposes for instance, connectivity and battery life. This has been raised as a challenge in numerous studies that the short span of mobile batteries inhibits their application in mLearning. Smaller screen sizes and keyboard were also noted as major challenges as it made typing long responses difficult [32]. Elias [37] also noted that lack of memory in mobile devices inhibit their use for mLearning. Several authors pointed out that technological constraint of mobile devices have to be overcome prior to actual implementation of mLearning methods.

Gikas and Grant [32] demonstrate that students are also frustrated by course instructors who are unwilling to incorporate technology such as mobile devices in their learning even if universities invest in provision of these technologies. This may be attributed to issues such as lack of skills on how to operate this technologies or generational difference in technology use [32]. Similarly, El-Hussein and Cronje [38] stated that only a few people have regarded mLearning as a core pedagogical activity in higher education institutions. Therefore inconsistent adoption of mLearning applications among relevant stakeholders remains a barrier to student adoption.

2.2.4 CURRENT DEBATES ON MOBILE LEARNING

The use of mobile devices for learning purposes is still in its infancy stages in terms of both technology and pedagogy. Thus there is a disagreement on how mLearning should be defined or conceptualized. Firstly, it is acknowledged that there is no standard definition or conceptualization of mLearning. Technologists focus on the mobility of the technology, while educationalists focus on the mobility of the learning material or content, some on the mobility of the student and others on the students' experience of learning with mobile devices. Everyone defines mLearning according to their own particular experiences [14] [5]. Similarly, El-Hussein and Cronje [38] indicated that it is impossible to attribute one fixed meaning to the concept of mLearning because understanding mLearning is challenging.

There is currently a misconception on understanding the nature of mLearning. Some consider it as a new paradigm while others merely consider it as a subset of eLearning or distance learning. Similarly El-Hussein and Cronje [38] indicated that mLearning opens the minds to the possibility of a new paradigm, which basically implies that mLearning is a new paradigm. It was stated that mLearning represents more than a mere extension of traditional forms of education but facilitates alternative learning processes and instructional methods that the theories of new learning identify as effective for learning [38].

It is difficult to make assumptions or conclusions on mLearning based on prior studies because there is no standardized theory on mLearning. This implies that it is not fit to generalize the findings of other theories in the context of mLearning. It is highlighted that as a result each author comes up with a different expectation about the scope and legitimacy of a theory in their work [38]. Therefore El-Hussein and Cronje [38] emphasized that there is need to place mLearning within the context of the theories' instructional design as well as understanding foundational assumptions of higher education.

Mobile learning has raised numerous questions amongst scholars since its inception. Some of these questions are: what new design paradigms and meanings can be attributed to the use of mobile technologies [38]? How can we appreciate their full significance within the context of traditional instructional design theory [38]? Do new millennium learners learn differently from the previous generations [38]? Is mLearning significantly different from current theories of classroom, workplace or lifelong learning [38]? Are students ready for mLearning now? All these questions are relevant to the context of mLearning and they need immediate attention before actual implementation of mLearning.

2.2.5 MOBILE LEARNING INITIATIVES IN BOTSWANA

In Botswana, mLearning is still in its infancy stages. Few tertiary institutions have adapted mLearning in their teaching and learning. Documented traces of mLearning initiatives can only be found at the University of Botswana, the Limkokwing University of Creative Technology and Botho University.

2.2.5.1 UNIVERSITY OF BOTSWANA

A smartphone based mLearning approach was implemented by the University of Botswana-School of Medicine to help physicians in specialty training. This mLearning initiative assisted physicians in training by providing access to medical resources and remote mentoring [39]. The physicians were provided with Android-based myTouch 3G smartphone with data enabled SIM and camera. The study revealed that smartphones loaded with the point of care tools are utilized effectively by physicians especially in resource-limited areas, both for medical information and for self-directed learning at home [39]. As a result of this mLearning initiative, physicians increased their usage for mobile phones attributing it to increased opportunity for use and growing familiarity. These clearly indicate that the introduction of mLearning programs in Botswana can yield fruitful results. However for the same program in a different study students reported that inadequate internet access is a challenge, and although SIM cards provide an alternative source of internet access the option was too expensive for students to pursue [40].

Physician students indicated interest to use mLearning for supplementary reading outside the hospital [39]. They requested increased access to academic journals. Indeed mLearning can leverage to support teaching and learning.

2.2.5.2 BOTHO UNIVERSITY

Botho University also launched Blackboard Mobile application which can be downloaded and accessed for free [41]. Learning resources (study material, presentation slides, and video lectures) are available and downloadable via the application. The Mobile Learning application allows staff and students to access and update course content that is available on Blackboard from their mobile devices.

2.2.5.3 LIMKOKWING UNIVERSITY OF CREATIVE TECHNOLOGY

The Limkokwing Mobile Academy provides course content to Web-enabled devices [42]. The application has no excessive hardware requirements. This is in line with recommendations by Koch [26] and Adedoja et. al [27] that mLearning applications need to be developed in such a way that the requirements are not financially demanding to students. It is evident that in Botswana mLearning still lags behind, as mLearning initiatives are not yet popular and widely applied in education [39].

There are different information systems models which have been used in previous studies to explain adoption. However TAM is the most prevalent. The next section discusses the various TAM which are TAM2, TAM3 and Unified Theory of Acceptance and Use of Technology (UTAUT). It also provides a justification as to why TAM is deemed appropriate for the current study.

2.3 TECHNOLOGY ACCEPTANCE MODEL

Most of the studies conducted to explain factors which influenced adoption of a certain information system employed TAM as the theoretical framework. This is because TAM is the most robust and widely used theory in Information Systems [10]. It specifically models user acceptance of Information Systems. It has been widely applied in a variety of fields such as business, agriculture, and healthcare with success. The goal of TAM is to explain and predict factors which determine the acceptance of computer applications [43].

It is evident from wide application of TAM that researchers not only want a model that can predict but also can explain why a particular Information System may be unacceptable and pursue appropriate corrective measures [12]. This model consists of a number of constructs as shown in figure 1:1 below.

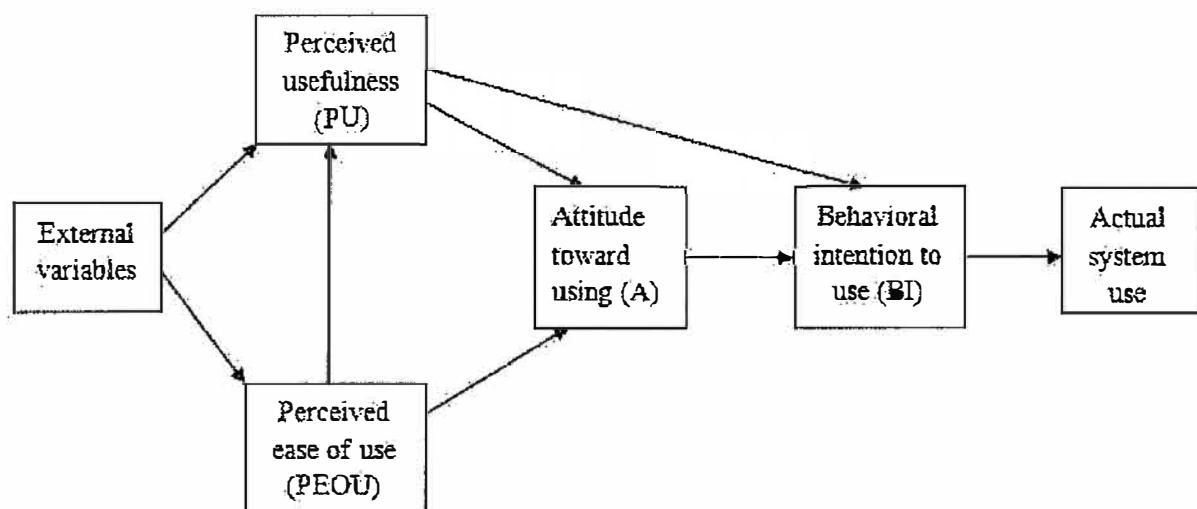


Figure 1: 0:1 Technology Acceptance Model (TAM)

1.1.1 DEFINITION OF CONSTRUCTS

Perceived usefulness (PU) has been defined by Venkatesh and Davis [44] as “the degree to which a person believes that using a particular system would enhance his or her job performance.” For the purpose of this study perceived usefulness refers to students believe that using mLearning applications would enhance learning performance and achievement.

Venkatesh and Davis [44] defined *Perceived ease of use* (PEOU) as “the degree to which a person believes that using a particular system would be free of effort.” For the purpose of this study perceived ease of use refers to students believe that using mLearning applications would be free of physical and mental effort.

Attitude toward using (A) has been defined by Ajzen [45] as “the individual’s positive or negative evaluation of the behavior.” For the purpose of this study attitude is the student’s positive or negative feeling about using mLearning applications.

Behavioral intention (BI) is the student’s plan to use mLearning applications.

1.1.2 EXPLANATION OF TAM

TAM indicates that the person attitude (A) towards using an Information System and perceived usefulness (PU) determines Actual usage, that is; $BI = A + PU$. Attitude (A) is determined by Perceived Usefulness (PU) and perceived ease of use (PEOU), that is; $A = PU + PEOU$. PU has a direct effect on BI over and above attitude. PU influences A as well. Also, PU can be affected by various external variables over and above PEOU, that is; $PU = PEOU + \text{External variables}$. PEOU is also theorized to be determined by external variables; that is; $PEOU = \text{External variables}$. The model depicts that BI is the major determinant of actual usage behavior; actual use should be predictable from measures of BI, and any other factors that influence actual usage behavior to do so indirectly by influencing BI [12]. External variables are not theorized to have any direct effect on attitude or behavior, instead affecting these variables only indirectly through PU and PEOU [43].

2.3.1 OVERVIEW OF TECHNOLOGY ACCEPTANCE MODELS

2.3.1.1 TECHNOLOGY ACCEPTANCE MODEL 2 (TAM2)

TAM2 came immediately after predecessor TAM. It explains PU and BI regarding social influence (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability and PEOU). Unlike TAM, TAM2 emphasizes on the effect of social pressures in influencing intention to use a particular system [44]. Although the model accounts for 40-60% of the variance in useful perception and 34-52% of intention, the model is more suited and relevant to the organizational context as opposed to an educational setting. As such some constructs such as job relevance are not appropriate in the educational context. This is clearly depicted by the fact that TAM2 was tested and validated on data from different organizations in a work context [44]. Although TAM was also validated in a work context, it is more generic making allowance for its application in varying contexts as opposed to being specific like TAM2. TAM2 is specific to the organizational context or working environment since most of the constructs are only relevant in the organizational setting.

2.3.1.2 TECHNOLOGY ACCEPTANCE MODEL 3 (TAM3) [46]

TAM3 was developed to explain how and why employees adopt and use IT in the workplace from an organizational point of view. To develop TAM3, TAM2 was combined with the model of the determinants of PEOU. Venkatesh and Bala [46] emphasized that the determinants of PU will not influence PEOU, and the determinants of PEOU will not influence PU. Thus there are no crossover effects in TAM3. It is highlighted that with an increase in experience the effect of computer anxiety on PEOU will diminish [46]. Venkatesh and Bala [46] indicated that the key strength of TAM3 is the comprehensive and actionable guidance. However, no research has been published validating the TAM3 model. Thus it could not be adopted in the current study.

2.3.1.3 UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

The development of UTAUT was triggered by the effort to integrate all the existing adoption models. It integrates Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), TAM, Combined TAM and TBP (C-TAM-TBP), Model of PC Utilisation (MPCU), Innovation Diffusion Theory (IDT) and Social Cognitive Theory (SCT). UTAUT holds that the key constructs namely performance expectancy, effort expectancy, social influence and facilitating conditions are direct determinants of information systems usage intention and usage behavior and age, gender, experience and

voluntariness moderate the impact of four key constructs on usage intention and behavior [47]. PE, EE, and SI are direct determinants of usage intention and behavior, and FC is a direct determinant of use behavior. Venkatesh et al., [47] provided a refined view of how the determinants of intention and behavior evolve over time. Some constructs in the UTAUT model are similar to TAM constructs, for instance, the PE construct in UTAUT is similar to PU in TAM Venkatesh 2003.

2.3.2 EVALUATION OF TECHNOLOGY ACCEPTANCE MODELS

According to Szajna [48] using the original TAM is more appropriate than using the two revised versions of TAM. The models were developed to explain information system adoption in the organizational context whereas mLearning adoption is more personalized to the learner. Therefore the models are not easily adaptable to mLearning. The users of the technology are learners and not employees. Therefore some constructs in the modified versions of TAM may not be applicable in the mLearning context.

TAM2, TAM3, and UTAUT posit that attitudes have no significant influence on usage intention. Thus the predecessors of the original TAM model removed the attitude factor from the model. However it is highlighted that attitudes have important effects on system use, and therefore need to be reconsidered in the TAM model [49].

TAM as compared to its counterparts is a generic model simplified to suit the varying contexts of information systems, for instance from file based systems, electronic and mobile applications. However, the main limitation of TAM as reflected by earlier studies is its inability to reveal determinants of PU and PEOU. Thus a significant number of scholars has criticized TAM that it is not a suitable theory since it can account for only 40% of behavioral intention to use a certain technology [12] [47] [44]. The determinants of PU and PEOU vary according to context hence the simplicity of TAM favour its application in different contexts as opposed to its predecessors.

In modified versions of TAM, some constructs such as job relevance found in UTAUT are irrelevant to the learning context. Similarly, Jambulingam [50] found that there is no significance of age and gender as moderating variables when applying UTAUT in the context of mLearning. As well as for Williams and Granger [51] the inclusion of age as a moderating variable in the model in the context of mLearning in tertiary institutions is irrelevant because the population mostly presents a homogenous age distribution. This clearly implies that it will be difficult to make generalizations on the distinct age groups

since a single age group dominates in tertiary institutions. Hence the application of TAM2, TAM3, and UTAUT offers limited applicability in the context of mLearning in tertiary institutions.

Also, social influence was not a significant predictor of BI in the context of mLearning [50] [52]. Jambulingam [50] indicated that the influence of classmates and lecturers is unnecessary because the digital generation is born with technology surrounding them, therefore eliminating the need to be influenced by others. Similarly, in a developing country context where mLearning is still at its infancy stages Iqbal and Qureshi [52] found that the influence of teachers, peers, and schools on mLearning adoption is insignificant. Venkatesh and Davis [44] highlighted that as individuals gain experience with a system over time, they rely less on social influence but judge a system's usefulness by potential benefits resulting from use. It was highlighted that mLearning usefulness and ease of use are the main driving forces of mLearning [52].

Venkatesh and Davis [44] found that subjective norm (SN) affects intention only when usage is mandatory, and experience is in early stages. This means that SN exerts a significant direct effect on usage intentions over and above PU and PEOU only for mandatory systems and not voluntary systems [44]. In the context of mLearning, technology use is voluntary therefore it is conclusive that social pressures such as subjective norm will not have any significant impact on intention to use mLearning applications [52]. This is consistent with TAM that there is a non-significant role for social influence on voluntary context [43].

This is a clear indication that we cannot have a one size fits all model, a generic model can be adapted to varying context. Moreover, TAM allows for its wide application by recognizing the influence of external variables on usage and behavioral intention, hence served as a theoretical background for many earlier studies in technology adoption.

2.3.4 REVIEW OF TAM IN MOBILE LEARNING

Previous studies on TAM have added additional constructs to TAM to suit the specific research interests and fields. It is evident that since its introduction, TAM has been widely applied due to its popularity and robustness [10]. Later on, it was developed into TAM2, TAM3 and UTAUT (Unified Theory of Acceptance and Use of Technology) by adding additional constructs. However, some authors believe that using the original TAM is more reliable and appropriate than using the modified versions [48].

TAM has been widely applied in education, for instance, to analyze factors influencing student's attitudes to engage in eLearning systems such as WebCT. In mLearning additional constructs such as self-efficacy (SE), relevance for students major (MR), system accessibility (SA), subjective norm (SN), Interest (I), perceived innovativeness (PI), perceived ICT anxiety, Quality of Service (QoS), perceived social interaction value, perceived mobility value (PMV), perceived enjoyment (PE) have been added to the original TAM [53] [27] [34] [33] [10] [9].

Findings from previous studies on the original TAM conflict with each other as to which factors are the key determinants of mLearning adoption. Some studies confirm the findings of TAM while others are in contrary with the model. For instance, it was found that only perceived innovativeness positively relates to behavioral intention to use mLearning, and also perceived innovativeness does not show high positive correlation with perceived usefulness of mLearning [33] [54]. This is in contrast to TAM that perceived usefulness and perceived ease of use are the key determinants [12].

PERCEIVED EASE OF USE AND PERCEIVED USEFULNESS

The TAM key determinants PEOU and PU were not found to be as robust as they were in previous studies; no significant paths existed between PEOU and PU and neither the relationship from PEOU to BI [54]. Instead perceived innovativeness was found to be a key determinant in predicting BI. This means that innovative users are more likely to adopt mLearning despite a high level of uncertainty in new IT adoption [54]. Perceived innovation is a significant predictor for PEOU and perceived (long term) usefulness [54].

A significant positive correlation between PU and PEOU with students attitude towards the use of mobile technology was found, which suggests that PU and PEOU can determine the attitude towards use [27] [34] [55]. The model depicts that PEOU is significantly correlated to PU, while PU is significantly correlated to BI and self-reported usage. Similarly, it was found that PU has the highest path coefficients thus is a significant predictor of BI [10]. This means that if mLearning is easy to use, a user may find it more useful, and hence has sufficient motivation to use it. Thus actual usage or behaviour is an indirect result of PEOU. It shows that users are motivated to adopt application first because of the functions it performs for them, and only secondly, based on how easy it is

to get system perform this functions [27] [55]. Similarly, it was found that BI to use mLearning applications was strongly influenced by PEOU and PU. These findings are consistent with TAM that PU and PEOU are the key determinants in the context of mLearning [12]. Therefore it is clear that a crucial aspect of introducing mLearning must consider the need to convince students of the usefulness of the technology to improve the quality and effectiveness of their studies [55].

Conversely, PEOU was found to have high mean value as compared to PU, which indicates that to some extent mLearning is easy to use [54]. Technological restrictions seem not to induce significant usability problems inhibiting mLearning adoption. However, Khanh [10] argues that PEOU has no significant effect on mLearning attitude [10]. This generates a feeling that general mLearning applications are not easy to use. This may be attributed to factors such as small screen size which would lead to small text sizes which can make information viewing from the mobile devices a tiring experience [27]. Similarly, Callum [55] argues that even if mLearning is seen as useful, it also needed to be seen as easy to use to have a positive influence on BI to adopt. If the mLearning content is difficult to access, search, download or is excessive in length, the usefulness of the mobile activity will be undermined [55].

ATTITUDE

Attitude has been found to be a key determinant in influencing BI [53] [56]. BI to use mLearning is mainly affected by PU and attitude [56]. This implies that both attitude and PU are critical factors in influencing actual usage of mLearning. Results also reveal that attitude is indeed a mediator between beliefs and user intention. Conversely, in a similar study, it was found that attitude is the least determinant of BI to use mLearning [34].

PERCEIVED (LONG TERM) USEFULNESS AND PERCEIVED (NEAR TERM) USEFULNESS

In a similar context PU was broken down into two constructs namely; perceived (long term) usefulness and perceived (near term) usefulness [54]. It is indicated that perceived (long term) usefulness is a stronger determinant of intention to use in an educational setting than perceived (near term) usefulness. Thus Liu et al., [54] argued that PU has lost its dominant explanatory power in favour of perceived (long term) usefulness. Therefore it can be concluded that the improvement of perceived (long term) usefulness is the key to

the success of mLearning, as it will promote both perceived (near term) usefulness as well as usage BI.

SYSTEMS COMMITMENT

System commitment and PU were found to be the strongest determinant of use intention. Hence improvement of university system support and PU is the key to the success of mLearning, as it will promote both the A and BI [10]. This reveals that support provided by the TEI to some extent can influence adoption of mLearning. Although no clear supporting evidence exists from existing literature.

PERCEIVED MOBILITY VALUE

Despite the fact that the success of mLearning is mostly inclined to the mobility value derived from mobile technologies, it was found that PMV does not affect PU [10]. However, it was indicated that perceived convenience positively affected PU and A towards using. Also PEOU positively affected perceived convenience [57]. Meaning the easier it is to use mLearning applications the more convenient it will be perceived by a user. It also shows that the more convenient the mLearning application, the more positive the attitude toward using the mLearning application. PEOU had a greater overall effect on PU than that on perceived convenience. This reveals that PEOU had a direct effect on attitude toward using and had an indirect effect on attitude toward using through perceived convenience and PU [57]. These support the conclusions reached in the original TAM. The order (great to small) for the overall effects of latent variables that affected attitude toward using was PEOU, PU, perceived convenience. Perceived convenience and PEOU did not affect intention to use directly, these two factors affected intention to use indirectly through PU and attitude toward using [57]. The order (from great to small) for the overall effect of the latent variables that affected intention to use was PU, PEOU, attitude toward using, perceived convenience. In general, this means that perceived convenience positively affected PU and attitude toward using, however, it did not affect intention to use directly but only affected intention to use indirectly through PU and attitude toward using. Also, it is highlighted that learners need to have a clear understanding of the convenience offered by mLearning so as to increase the adoption rates [58].

Similarly, PMV was found to predict user intentions of using mLearning [56]. PMV has a positive effect on PU. PMV significantly increases an individual's awareness of

usefulness. The more a user appreciates the value of mobility, the more the user will perceive that mLearning is useful. Thus PMV plays a crucial role in user perception of mLearning. The most significant value of mobile technology is mainly the mobility aspect offered by mobile technologies, which serves as a significant factor for mLearning adoption and acceptance [56]. Mobility allows mLearning to become an important channel for obtaining learning material.

2.3.5 JUSTIFICATION OF EXTERNAL VARIABLES

PERCEIVED MOBILITY VALUE

Previous studies indicated that students valued the anywhere anytime aspect of mLearning. This indicated that mLearning is valuable mainly due to its mobility aspect. Although the perceived mobility value has been tested in previous studies, the findings are contradictory. For instance, in a study conducted by Trifonova [8] it was found that PMV does not have any significant influence on PU while on a similar study it was found that PMV could predict user intentions to use mLearning [50]. Thus there is a need to validate the results in various contexts. Also, Kukulska-Hulme [59] emphasized that there is a need to move beyond a superficial understanding of mLearning which does not give sufficient consideration to how mobility affects students to adopt mLearning.

It is inevitable that PMV is the main distinguishing aspect of mLearning from another form of learning. Therefore there is a need to determine whether this aspect has an impact on student learning or not. Therefore PMV is a critical factor which needs to be considered in the TAM. Thus PMV is introduced as an external variable in TAM.

MOBILE READINESS

There are several studies that addressed the readiness levels of tertiary students to mLearning. However few studies have introduced this variable as an external variable into the TAM to find out whether it has a significant influence on mLearning adoption. Originally TAM does not provide analysis of negative factors which may impact on the adoption of certain information systems. Therefore it is appropriate to study the readiness levels of students towards the adoption of mLearning.

MOBILE EXPERIENCE

There is limited knowledge as to how mobile experience impact students to adopt mobile technologies for learning purposes. According to Szajna [48] an additional experience variable added to the TAM will be a significant enhancement. Similarly, Venkatesh and Davis 1996 [60] added computer experience to TAM and found a significant positive impact. As highlighted before, since the majority of tertiary students own mobile devices they might use the mobile experience they have to engage in mLearning. Thus develop a positive attitude towards mLearning since they have necessary mobile experience.

2.4 RESEARCH GAPS IN TAM IN THE CONTEXT OF mLEARNING

Previous studies have been conducted in developed countries in institutions where there are policies and regulations governing the use of mLearning applications among tertiary students. However, limited knowledge exists on key factors influencing mLearning adoption in developing countries where tertiary institutions do not have policies for implementation of mLearning applications in teaching and learning.

From previous studies, most of the studies on adoption of mLearning were entirely quantitative. However, there is a concern on IS research that mixed method approach in information systems is fading away [61]. Venkatesh et al [61] also highlighted that mixed method approaches are essential since they build on a common scientific basis essential to advance and sustain the tradition of methodological diversity in information systems research and to create a cumulative body of knowledge.

Mobile learning is still in the early step of introduction and needs more studies focusing on the implementation of mLearning in the educational context in order to validate the findings. It is emphasized by previous studies that there is a need for testing in various educational settings and populations so that generalizations can be based on empirical data and not on assumptions only.

Frequent use of mobile devices did not translate into readiness for mobile teaching and learning. Although studies on readiness have been conducted, it mostly focuses on readiness in developed countries where facilities and technologies which support mLearning are easily and readily available. Therefore there is a need to determine mLearning readiness in developing countries where there are limited facilities which

support mLearning. This will help in providing better and clearer insights into the issue of readiness of using mLearning approaches in developing countries.

There is an argument or disagreement on previous scholars on the key determinants which influence students to adopt mLearning. Hence there is a need explore TAM to find out the key determinants of mLearning adoption among tertiary students.

Most of the studies conducted on mLearning adoption lack theoretical foundation in information systems. Limited studies were found which used information systems theories or models to provide a theoretical background for their studies. Therefore it raises arguments on the suitability and applicability of such studies in the field of information systems. Thus it is necessary to explore the suitability and applicability of various technologies basing on existing information system theories, models and frameworks.

2.5 HYPOTHESIS DEVELOPMENT

Based on the results from the literature review the following hypotheses were formulated to test relationships and correlations between the proposed model constructs.

- H1: Perceived Mobility Value (PMV) has a positive effect on Perceived Usefulness (PU)
- H2: Perceived Mobility Value (PMV) has a positive effect on Perceived Ease of Use (PEOU)
- H3: mReadiness (mR) has a positive effect on PU
- H4: mR has a positive effect on PEOU
- H5: mR has a positive effect on Attitude (A)
- H6: Mobile Experience (mE) has a positive effect on PU
- H7: mE has a positive effect on PEOU
- H8: PEOU has a positive effect on PU
- H9: PEOU has a positive effect on A
- H10: PU has a positive effect on A
- H11: PU has a positive effect on BI
- H12: A has a positive effect on BI

2.6 SUMMARY

It is evident that TAM is the promising theoretical framework in education. It is conclusive that PEOU, PU, and other external variables can influence adoption of mLearning. When applying TAM in another context, the external variables for that context need to be taken into consideration and examined carefully to ensure that TAM is a viable model for that context. Crucial factors which are relevant to mobile learning such as the student's readiness levels, mobility value and mobile experience of mobile technologies need to be taken into consideration when adopting the TAM. Therefore it is evident that only fewer studies have addressed these issues relevant to mLearning. Also from previous studies, findings are on the contrary hence need for further research.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the research philosophy and research design employed in carrying out this research. The methodology chapter entails research strategy, research design, sampling techniques and data collection methods employed in the study. It also discusses how the relationship between TAM constructs will be analysed and assessed.

3.2 RESEARCH PHILOSOPHY

A research philosophy is what constitutes a valid research and which research methods are appropriate for the researcher to adopt in a research enquiry [62]. Theivananthampillai and Cua [63] noted that the philosophical assumption affects the choice of research methods, which in turn influence the way the researcher collect the data. Also Myers [64] indicated that all research, whether quantitative or qualitative, is based on some underlying assumptions about what constitutes a valid research and which research methods are suitable or appropriate for that kind of research. Myers and Avison [62] highlighted on three research philosophies guiding a study in information systems, namely positivists, interpretive and critical perspective.

3.2.1 Positivist perspective

In a positivist perspective the researcher generally assumes that reality is objectively given and can be described by measurable properties, which are independent of the observer and the research instrument used by the researcher [62]. Creswell [65] indicated that quantitative studies mostly adopt the positivist perspective. Myers and Avison [62] highlighted that the main aim of a positivist perspective is to increase the predictive understanding of phenomena. Similarly Theivananthampillai and Cua [63] stated that the purpose underlying positivist perspective is to verify proposition with the hope that the accepted theory can be used to predict consequences of information technology use. Creswell [65] pointed out that positivism is the traditional form of research and it is sometimes called the post positivist or empirical science research.

3.2.2 Interpretive perspective

Theivananthampillai and Cua [63] noted that while positivist perspective view reality as static point in time, the interpretive perspective is more dynamic in nature. This means that

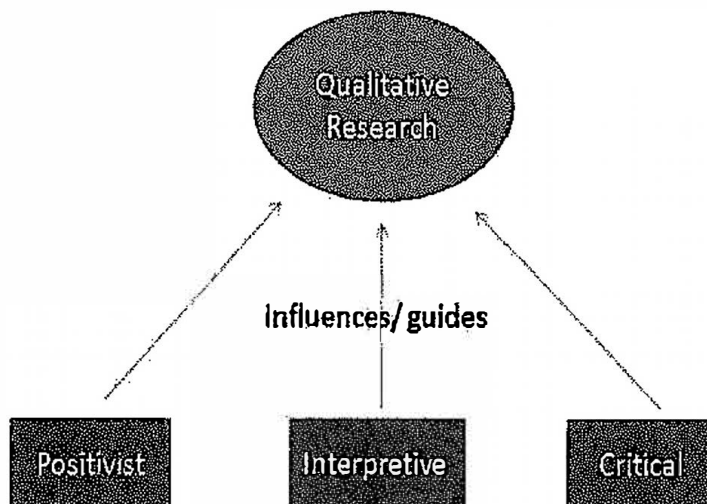
the interpretive researcher view deployment of information technology as an intervention in a social system, as a result it will alter the system state. According to Myers and Avison [62] in an interpretive perspective the researcher assumes that reality is only through social constructions such as language, consciousness and shared meanings. The main aim of an interpretive perspective is to attempt to understand phenomena through meanings that people assign to them.

3.2.3 Critical perspective

In a critical perspective the researcher assume that social reality is historically constituted and that it is produced and reproduced by people [62]. Theivananthampillai and Cua [63] emphasised that the conscious involvement or non-involvement of users with regards to information technology use is influenced by user's expected outcomes and perception of control toward achieving those outcomes. The main task of a critical perspective is seen as being one of social critique focus on oppositions, conflicts and contradictions in contemporary society.

The diagram below summarises the philosophical assumptions used in information systems researches as depicted by Myers and Avison [62].

Figure 3:1 Research philosophies in information systems by Myers and Avison [62]



Theivananthampillai and Cua [63] noted that among the three theoretical perspectives of research, positivist research is suitable for theory testing where there is evidence of formal propositions and quantifiable variables to draw inference. On the other hand, interpretive perspective is suitable for theory generation because it attempts to understand phenomena

through the meanings people assign to them, while critical perspective strives to resolve conflicts and contradictions [63] [64].

3.2.4 Pragmatism

Pragmatism is commonly used when the researcher chooses not to focus on research methods but on the research problem [65]. The pragmatism philosophy is applicable when the researcher chooses more than one view of the world, thus in these study both positivism and interpretive view were adopted sequentially to answer the research questions. The pragmatic philosophy was chosen in the current study because the inquiry was based on the assumption that collecting the diverse types of data best provides an understanding of the factors that influences tertiary education students in Botswana to adopt mLearning applications.

Saunders et al. [66] summarised research philosophies applicable to management science in a table. The table below was adapted from Saunders et al. [66] to show the meaning of different worldviews adopted by researchers in management science. According to Creswell [65] a worldview is a general orientation about the world and the nature of research that a researcher holds. As depicted by the table 3:1, the current study adopted the pragmatism world view.

Table 3:1 Research Philosophies in Management Science by Saunders et al. [66]

	Positivism	Realism	Interpretive	Pragmatism
Ontology: the researcher's view of the nature's reality or being	External, objective and independent of social actors	Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist)	Socially constructed, subjective, may change, multiple	External, multiple, view chosen to best enable answering of research question

Epistemology: the researcher's view regarding what constitutes acceptable knowledge	Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisations, reducing phenomena to simplest elements	Observable phenomena provide credible data, facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts	Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective meanings motivating actions	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data
Axiology: the researcher's view of the role of values in research	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research	Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view
Data collection techniques most often used	Highly structured, large samples, measurement, quantitative, but can use qualitative	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative	Mixed or multiple method designs, quantitative and qualitative

According to Creswell [65] the pragmatic researchers draw assumptions liberally from both quantitative and qualitative approaches when they engage in research and are free to choose the research methods and techniques that best answer the research questions and research problem. The pragmatists do not view the world as an absolute unity; however they look for various ways of collecting and analysing data as opposed to relying on a single approach. Pragmatism opens a door for the mixed method researcher to choose multiple methods, multiple worldviews, different assumptions and different forms of data collection and analysis [65].

3.3 RESEARCH DESIGN

Burns and Grove [67] and Kothari [68] define research design as the conceptual structure within which the research is conducted or implemented. It is also defined as the blueprint

inform the other) to understand a phenomenon of interest. A mixed method research is sequential when the researcher seeks to elaborate on or expand the findings of one method with another method. This may involve beginning with a qualitative method for exploratory purposes and following up with a quantitative method with a large sample so that the researcher can generalize results to a population [61]. A concurrent method is when the researcher collects both forms of data at the same time during the study and integrates information in the interpretation of the overall results [61]. The study followed a sequential mixed method approach. Furthermore Creswell et al. [69] highlight that in a mixed method approach the researcher base knowledge claims on pragmatic grounds that is on the assumption that collecting diverse types of data best provides an understanding of a research problem.

The major strengths of mixed method research are that it addresses confirmatory and exploratory research questions simultaneously within the same research inquiry. It also offers rich insights on various information systems phenomenon, as a result helping the researcher to make better and more accurate inferences. It also enables the researcher to find contradictory or complementary conclusions. Divergent findings are valuable because they lead to a re-examination of the issue by enriching our understanding of a phenomenon and also open new avenues for future enquiries. Complementary findings are valuable in the sense that it provides a holistic view of a phenomenon. The use of mixed methods research broadens the researchers understanding of a particular phenomenon [71].

According to Creswell et al. [69] if the research is identifying factors that influence an outcome or understanding best predictors of an outcome a quantitative approach is the best. If a phenomenon needs to be understood because the topic is new or when the researcher does not know the important variables to examine a qualitative approach is appropriate [69] [72]. Therefore the current study adopted the mixed method approach because the current study is concerned with identifying and examining factors which influence mLearning adoption. Thus a mixed method approach is deemed appropriate.

The goal of mixed method research is not to replace either quantitative or qualitative approaches to research but to draw from the strengths of these approaches and minimise possible weaknesses [73].

A mixed method exploratory research design allows the researcher to collect and analyse qualitative data as phase one and in the second phase the researcher builds on the results of

the qualitative data [69]. The theoretical framework allows the researcher to identify topic specific themes and variables for further investigation.

The strategy generates findings that are representative of the entire population to be studied at a lower cost than collecting data for the entire population [66]. Both quantitative and qualitative data were collected. Qualitative data was used during the preliminary stages of the study to identify and understand the factors which influence adoption of mLearning among tertiary students. Quantitative data analysis was employed at the late stages of the study to examine the relationships amongst external variables, key determinants and behavioral intention to use mLearning. The research involved quantitative data during the later stages because it involves manipulation of numerical data to test the hypothesis [66]. Numerical data was analysed to test the relationship amongst the TAM model constructs. Analysis of constructs is the main focus of a quantitative study [66]. Qualitative data was obtained through group interviews.

3.4 POPULATION AND SAMPLE

Stratified random sampling was adopted for the research. Stratified random sampling means dividing the population into relevant and significant strata based on one or more attributes [66]. Specifically, the strata will be derived based on whether a TEI is a public or private institution. Then from each stratum, a random sample is drawn. Dividing the population into a series of relevant strata means that the sample is more likely to be representative as you can ensure that each of the strata is represented proportionally within the sample [66].

The population comprised of public and private TEI in Botswana, namely University of Botswana (UB), Botswana International University of Science and Technology (BIUST), Botho University and Limkokwing University of Creative Technology. The setting for the research is Botswana. Thus the findings were generalised based on the setting of the research.

Data analysis using SEM qualifies a sample size of 50 as very poor, 100 as poor, 200 as fair, 300 as good and 500 as very good [74]. As indicated by Kline [74] SEM requires a large sample size, due to the assumptions made or not made about the data. Therefore the sample size for the study was 480, distributed proportionally to each stratum.

3.5 INSTRUMENT AND PILOT STUDY

A pilot study was conducted with 15 students to test for reliability of the measurement instrument. Cronbach's alpha was used to assess the internal consistency of the items. DeVellis [75] indicated that Cronbach's alpha below 0.60 is poor, between 0.60 and 0.65 are undesirable, 0.65 to 0.75 are minimally acceptable, 0.70 to 0.80 are respectable, and 0.80 to 0.90 are very good. The Cronbach's alpha values measure how well an observed variable measures the proposed TAM model constructs. The seven-point Likert scale was replaced with a five-point Likert scale. Because during the pilot study respondents recommended that seven point likert scale is confusing as a result they ended up circling incorrect responses, thus opted for five point scale. The demographics had a variable indication family income, but during the pilot respondents were reluctant to answer the question; 80% of respondents did not answer it. Thus it was removed from the measurement instrument.

Appendix B shows a summary of reliability analysis of the pilot study. The Cronbach's alpha for Perceived Security construct yielded insignificant results thus it was removed from the measurement instrument. Although students indicated that they are concerned about the security of mLearning applications (especially when they have to conduct online quizzes and tests via the applications), it yielded insignificant results. Therefore the questionnaire now measured nine constructs only which are PU, PEOU, BI, ATT, PMV, ME, PT, PP and mR.

The deletion of the first item for PMV raised the Cronbach's alpha from .918 to .921 thereby increasing the reliability. Since the Cronbach's alpha would increase but not significantly, the item was retained. However the last item for mR was deleted, because if the item is deleted the alpha increased significantly from .811 to .829. Similarly, the second item measuring Perceived Usefulness, which is PU2 was deleted because deletion raised the alpha from .912 to .922.

3.6 CONCEPTUALISATION AND OPERATIONALISATION OF EXTERNAL VARIABLES

Perceived Mobility Value (PMV) refers to the ability to allow users to access and check information needed anywhere and anytime through mobile devices [76]. In the context of

mLearning and the concern of this study, PMV refers to the ability to allow students to access and check information needed anywhere and anytime through mobile devices.

Mobile Readiness (mReadiness) refers to the propensity to embrace and uses mobile device for accomplishing goals in learning [7]. Therefore for the purpose of this study mReadiness has been conceptualized as the propensity to embrace and use mobile devices for learning purposes.

Mobile Experience

The definition for mobile experience was derived from a study by Alenezi et al., [77]. The study analyzed factors to adopt e-learning by adding internet experience as an external variable. Internet experience was defined as the extent of a person's experience to perform specific tasks using the internet [77]. In the context of mLearning and concern of the current study mobile experience is defined as the extent of a person's experience performing tasks using mobile devices.

OPERATIONALISATION OF VARIABLES

External variables were operationalised by using validated items from previous research. Items on PU were adapted from Davis [39] and Davis, Bagozzi and Warshaw [40] studies, items on PEOU from Davis, Bagozzi and Warshaw [40] study, items on attitude, behavioral intention and perceived mobility value from Huan and Lin [35], items on mobile experience were adopted from [77] [78] and items on mobile readiness from [56]. The questions were also modified where appropriate to suit the context of mLearning. Perceived privacy and perceived trust were operationalised based on the comments made by students during group interviews.

3.7 DATA ANALYSIS

3.7.1 QUANTITATIVE DATA ANALYSIS

The quantitative data derived from the questionnaires was entered into and analysed using Statistical Package for Social Sciences (SPSS) and into the Lisrel program (student version). The model fitness was tested through SEM by using LISREL (student version).

3.7.1.1 DATA ANALYSIS FOR RESEARCH QUESTIONS

Table 4:1 indicates the statistical methods and approaches conducted to solve each research question.

Table 4:Error! Use the Home tab to apply 0 to the text that you want to appear here.:2
Data Analysis for research questions

RESEARCH QUESTION	VARIABLES	APPROACH	METHODS
1. What is the level of mLearning readiness among tertiary education students in Botswana?	Mobile Readiness (Technology, budget and skills readiness)	Find mean, percentage, standard deviation and variance	Descriptive analysis
2. What are the factors which influence mLearning adoption among tertiary education students in Botswana?	1. External variables (Mobile Readiness, Mobile Experience, Perceived Mobility Value, Perceived Trust, Perceived Privacy) Intention to use 2. Key determinants (Perceived Usefulness, Perceived Ease Of Use) 3. Attitude 4. Behavioral Intention	Path coefficients	Pearson correlations
3. What is the relationship among external variables, key determinants, attitude towards using and intention to adopt mLearning?	1. External variables (Mobile Readiness, Mobile Experience, Perceived Mobility Value, Perceived Trust, Perceived Privacy) Intention to use 2. Key determinants (Perceived Usefulness, Perceived Ease Of Use) 3. Attitude 4. Behavioral Intention	-Find missing data, outliers, normality, linearity -Find relationship among variables	Pearson Correlation Descriptive analysis
4. Which variables are most	1. External variables (Mobile Readiness, Mobile Experience,	-Find significant path	Path Analysis

influential in predicting intention to use mLearning?	Perceived Mobility Value, Perceived Trust, Perceived Privacy) Intention to use 2. Key determinants (Perceived Usefulness, Perceived Ease Of Use) 3. Attitude 4. Behavioral Intention	coefficients among variables in the model to depict most influential variables	Multiple regression analysis
3. Validation of the proposed model.	1. External variables (Mobile Readiness, Mobile Experience, Perceived Mobility Value, Perceived Trust, Perceived Privacy) Intention to use 2. Key determinants (Perceived Usefulness, Perceived Ease of Use) 3. Attitude 4. Behavioral Intention	Fit indices Root Mean Squared Residual (RMSR) Root Mean Square Error of Approximation (RMSEA) Goodness of Fit(GFI) Adjusted Goodness of Fit (AGFI) Normalised Fit Index (NFI) Comparative Fit Index (CFI) Critical N (CN)	SEM (LISREL)

3.7.1.2 DATA SCREENING

Missing data: The problem of missing data is beyond the researcher's control. The basic method of mean substitution of replacing a missing score with the overall mean was employed [74].

Outliers: Outliers are values which are different from the rest. Mahalanobis distance was used to identify outlier items from the constructs. Mahalanobis distance shows how one observation in the data is distantly located from the others [79]. The causes for such an outlier was analysed, and the decision whether to keep or reject that particular item was based on the values of the variable.

3.7.1.3 ASSUMPTIONS OF MULTIVARIATE ANALYSIS

Normality and Linearity: Normality holds that points for all values should form an approximately straight line. Linearity holds that a scatter plot should form a rectangular shape and scores should be concentrated in the centre, any other pattern or clustering of scores is considered a violation.

Homoscedasticity: This means that the regression line is the same for all predictor variables. Box M's was used to assess this if Box M's is less than 0.05 the null hypothesis should be rejected.

Multicollinearity: This is a situation where two or more independent variables in a model are highly correlated, that is two separate variables measuring the same thing. If these measures are highly related, the results of certain statistical tests may be biased [79]. Multicollinearity was assessed through squared multiple correlation and variance inflation factors. If SMC is greater than 0.90 for a particular variable, it shows extreme collinearity or serious problem. If VIF is greater than 10.0 the variable is redundant [74]. In such cases, one of the two variables was excluded from further analysis.

3.7.1.4 DESCRIPTIVE ANALYSIS

Demographic data were analysed using descriptive statistics to depict demographic details of the respondents. Descriptive statistics entails mean, percentages and standard deviation of all demographic variables.

3.7.1.5 ASSESSMENT OF THE MEASUREMENT INSTRUMENT

Reliability

Cronbach's alpha was used to measure the internal consistency of the measurement instrument. The range of values for Cronbach's alpha is from 0.00 to 1.0; 0.00 indicates no consistency in measurement and 1.0 indicates perfect consistency. For acceptable results, Cronbach's alpha is recommended to be greater than 0.7 meaning that 70% of the variance in the scores is reliable variance.

Validity

Karras [80] emphasised that behavioral science surveys must set content validity as their goals. Thus content validity was performed on the measurement instrument. Content validity refers to the inclusion of items that are truly representative of the construct to be measured. Seven constructs were adapted from previous studies and two from interviews with students. The two constructs thus were operationalised and conceptualised based on the students' responses and feedback. The questionnaire was provided to four experts to assess and analyse how well the items measure each of the specific constructs. Therefore from the feedback obtained from the four experts, content validity for the study was deemed appropriate.

3.7.1.6 ASSESSMENT AND TESTING OF MODEL

The measurement model analysis was employed in the research to investigate whether all the measured variables measure what a latent variable attempts to measure in the research model. Exploratory factor analysis was conducted using SPSS to extract model constructs. Confirmatory factor analysis using LISREL was done to assess the model in terms of factor loadings and reliability of measures.

The fitness of the model was analysed to ensure that the hypothesised model is consistent with the actual data. Therefore several Goodness of Fit (GOF) measures were used to analyse the model to estimate the measurement model fit. GOF refers to how well the data fits into the statistical model [81]. The entire model fit was assessed, which determined

whether to accept the structural model [74]. Model fit indices that were explored and analysed in the study involves: goodness of fit (GFI), adjusted goodness of fit (AGFI), Normalized fit index (NFI), Comparative fit index (CFI), Root mean square residual (RMSR), Root mean square error of approximation (RMSEA), Root mean squared residual (RMR) and Critical N (CN). Appendix A depicts the overall evolution of the model during analysis and assessment of the model.

3.7.2 QUALITATIVE DATA ANALYSIS

Interviews were conducted with 7 students in BIUST and Botho during the preliminary stages of the study mainly to understand individual factors that influence students to adopt mLearning applications. Non-verbal cues of participants were observed during the interview sessions. An audio recording of sessions was also conducted in order to aid during qualitative data analysis. According to Markle [82] the audio tapes are the primary source of data for data analysis. Similarly, it is emphasized that the use of audio tapes in qualitative research is a significant advancement in research in general [82]. Also, a diary of reflective notes was kept to keep track of time, place and key points of the interview session.

The audio-recorded interviews were transcribed immediately after each interview session. The audio records were played multiple times before actual transcription process. Rapley [83] indicated that the process of making detailed transcripts of actual recorded data immediately after the interview process enables the researcher to become familiar with the subject matter or content. Rapley [83] also emphasized that interesting themes may also emerge as people interact during the process of recording.

Summary of transcribed data was conducted in order to identify key points or themes emerging from the transcripts. Data transcription basically entails transforming the audio file into written words. The meaningful categories relating to the data were developed. Transcription means reproducing audio recorded data into a written word processed format. Similarly Widodo [84] defines transcription as the process of turning digitally recorded interview findings into transcripts. It is basically designed in qualitative researches to capture the meaning of naturally occurring phenomena in social encounters [84]. Gale et al. [85] stated that the process of transcription is a good opportunity to become immersed in the data and is to be strongly encouraged for new researchers. The

process of transcript analysis is viewed as an exploratory, qualitative methodology [86]. Garrison et al. [86] highlighted that the process of analyzing transcripts during research helps educators to investigate beyond what students say they do to reviewing what they actually do.

A deductive approach was used to organise and direct qualitative data analysis, that is theoretical propositions were used to aid data analysis. Commencing the research study from a theoretical perspective links the research into the existing body of knowledge in a particular subject area.

The categories were developed and they aided in the development of factors deployed in the development of the model for predicting mLearning adoption. The categories were used as the initial platform for quantitative study. The categories were derived from the data based on actual terms or emerging themes from the participants.

Finally, the data was unitized, that is reducing and re-arranging data into a manageable and comprehensible form. The data was attached to the identified categories to ensure that each and every piece of data is represented in the identified categories.

The following manual process was adopted from Saunders [66] to code data transcripts during qualitative data analysis:

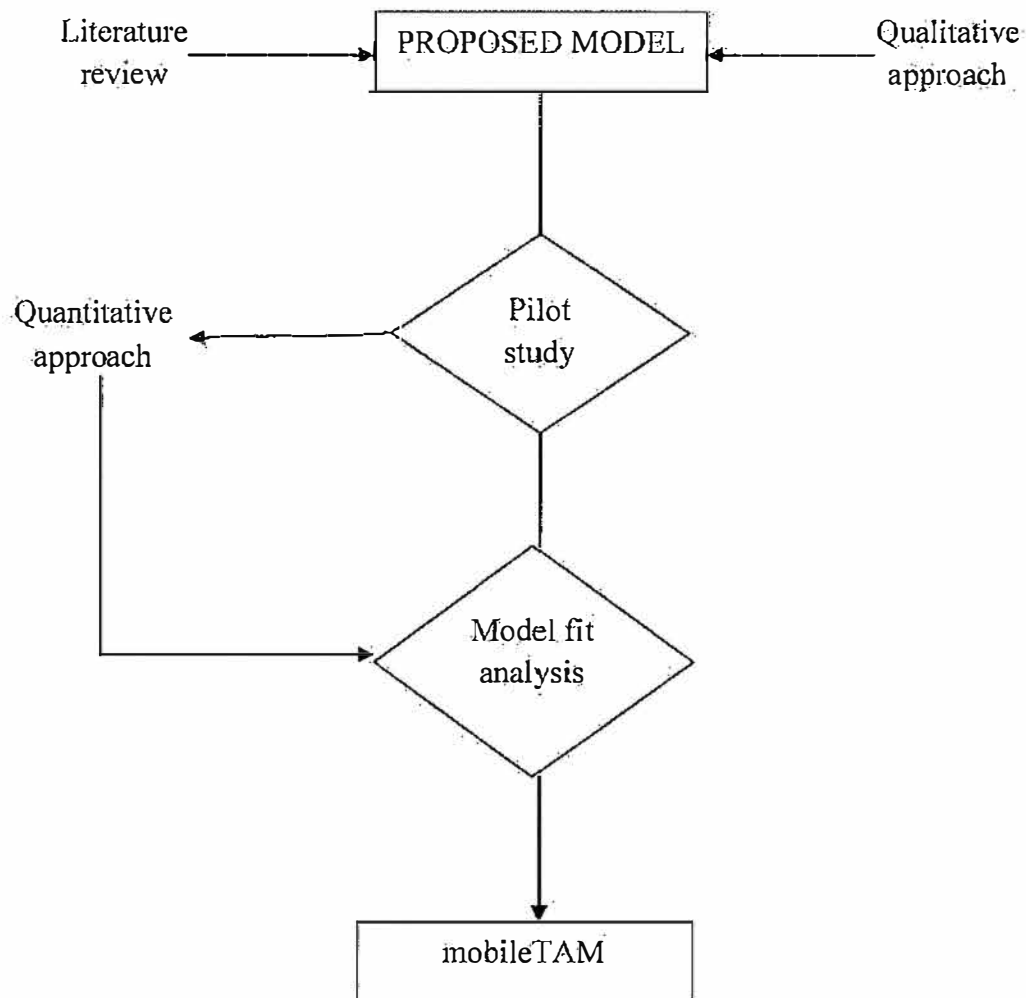
1. Listening of audio interview files multiple times to familiarise with the content
2. Production of a summary of key points that emerge from audio data (helps to compress long sentences into short sentences).
3. Categorisation of data. The categories were derived from the theoretical framework as well as from the data.
4. Data Unitisation. The collected and transcribed data is attached under various categories
5. Subdivision or integration of categories

The approach was chosen because Garrison et al. [86] emphasized that a simple method is needed to lead to a reliable code, as a result a reliable coding approach has to be simple so that it does not introduce added complexity to the qualitative data.

3.7.3 SUMMARY OF THE RESEARCH APPROACH FOR DEVELOPING THE MODEL

Figure 3:2 illustrates the approach followed to develop the mobileTAM model in a diagram format.

Figure 3:2 The approach for developing mobileTAM



3.7.4 CHAPTER SUMMARY

The chapter discussed the research design employed to develop a model for mLearning adoption amongst tertiary education students in Botswana. The justifications for methods and approaches used are also discussed. It also discussed the type of statistical analysis conducted to test the model.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

The purpose of this chapter is to present the results or findings of the study. Firstly it presents results of data screening and demographic variables. Secondly, it presents results of quantitative data analysis using SPSS and Lisrel program followed by qualitative data analysis. The chapter ends with a summary of main findings.

4.2 QUANTITATIVE DATA RESULTS

4.2.1 RESPONSE RATE

A total of 480 questionnaires were issued to respondents (120 questionnaires per tertiary institution) and only 403 were obtained. Thus the overall response rate was 84% (403/480).

4.2.2 DATA SCREENING

Due to circumstances beyond the researcher's control, there were missing items in the data. The missing items were replaced with mean values for each specific variable because if the cases with missing items were deleted it would reduce the sample size significantly.

From the data set, 9 cases with outliers were detected using Mahalanobis distance. The cases with outliers were cross-checked against data on the questionnaires. It was found that the outliers are a result of true results indicated by the respondents. However, a decision to remove the outliers on the dataset was reached.

Normality was examined and the points for most values approximately formed a straight line in the Q-Q plots as shown in Figure 4:1. However, the data showed skewness to the right. This is indicative that the normality assumption is violated. To guard against non-normality of data, the predicted variable BI was transformed using the log function in SPSS. Figure 4:2 shows results for this transformation. No skewness or kurtosis violations were reflected. Thus the normality assumption was satisfied as almost all points lie on the straight line.

Figure 4:1 Non- normal distribution of data

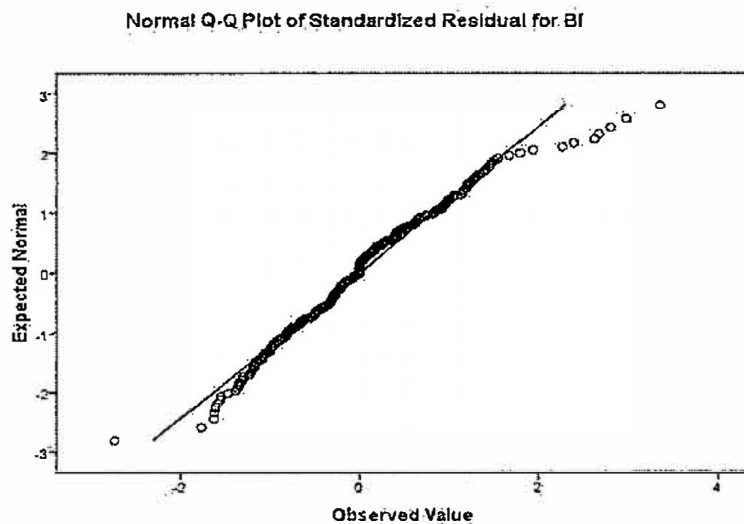
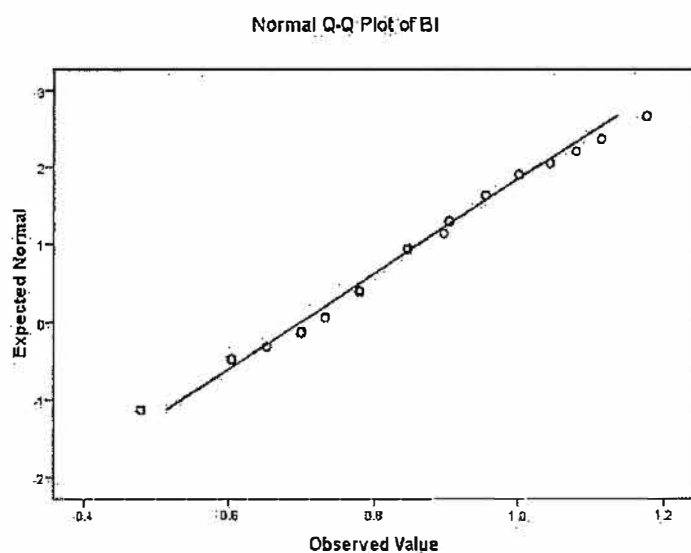


Figure 4:2 Normal distribution of data



Results for linearity depicted that for most variables, the scores were concentrated in the centre which indicates that linearity assumption is satisfied. Appendix F shows the distribution of scores for linearity.

The results for homoscedasticity were non-statistically significant (Box's M test=36.509, $\rho=0.448$). Therefore the null hypothesis was accepted because the result met the assumption of equal covariance matrices.

The results for collinearity indicated that values for Tolerance ranged from .656 to .878 (far from zero) and for Variance Inflation Factor values ranged from 1.138 to 1.523 (less than ten). Thus results as depicted in Appendix G indicated that multi collinearity assumption was satisfied.

4.2.3 DESCRIPTIVE ANALYSIS

4.2.3.1 DESCRIPTIVE ANALYSIS OF DEMOGRAPHIC VARIABLES

Table 4:1 shows the descriptive statistics of demographic variables. It shows the frequency of occurrence of each demographic variable, percentage and cumulative percentage.

Table 4:3 Descriptive Statistics of Demographic Variables

	Frequency	Percentage (%)	Cumulative Percentage (%)
1. Age			
Less than 20	56	14.2	14.2
Mean score	1	0.3	14.5
20 to 25	322	81.7	96.2
26-30	14	3.6	99.7
31+	1	0.3	100
2. School			
Botho	98	24.9	24.9
BIUST	122	31.0	55.8
Limkokwing	72	18.3	74.1
UB	102	25.9	100
3. Year of Study			
Year 1	79	20.1	20.1
Year 2	174	44.2	64.2
Year 3	79	20.1	84.3
Year 4	53	13.5	97.7
Year 5 +	9	2.3	100
4. Gender			
Male	189	48.0	48.0
Mean score	1	0.3	48.2
Female	204	51.8	100
5. Mobile device ownership			
Yes	392	99.5	99.5

No	2	0.5	100
6. Mobile learning use			
Yes	349	88.6	88.6
Mean score	1	0.3	88.8
No	44	11.2	100
7. Mobile device internet access			
Yes	353	89.6	89.6
Mean score	5	1.3	90.9
No	36	9.1	100
8. Mobile device memory card			
Yes	335	85.0	85.0
Mean score	5	1.3	86.3
No	54	13.7	100
9. Mobile device has Microsoft Office tools			
Yes	284	72.1	72.1
Mean score	5	1.3	73.4
No	105	26.6	100

4.2.3.2 DESCRIPTIVE STATISTICS OF CONTINUOUS VARIABLES

Table 4:2 depict the descriptive statistics of continuous variables in the study. The mean values of the original TAM constructs were; PU was 10.9 (SD=4.1), PEOU 16.0 (SD=3.5), ATT 12.6 (SD= 2.6), BI 0.7(SD= 0.2) and mean scores of external variables were PMV 6.3 (SD= 2.4), MR 14.7 (SD= 4.4), PT 10.6 (SD=2.8) and PP 7.7 (SD=2.8).

Table 4:4 Descriptive statistics of Continuous variables

	Mean	Standard deviation	Variance	Minimum	Maximum
PU	10.9	4.1	16.5	6	27
PEOU	16.0	3.5	12.1	7	26
ATT	12.6	2.6	6.8	5	21
BI	0.7	0.2	0.027	0.48	1.18
PMV	6.3	2.4	5.7	3	14
MR	14.7	4.4	19.1	8	33
PT	10.6	2.8	7.8	3	15
PP	7.7	2.8	7.8	3	15

4.4 MOBILE READINESS

Table 4.3 indicates the overall readiness of students towards mLearning in terms of technology, skills and budget readiness.

4.2.4.1 Technology Readiness

The results generally indicate that most of the students are ready for mLearning in terms of technology ownership, skills needed to engage in mLearning activities and alignment of their budget to incur costs for mLearning purposes. The results indicates that 99.5% (n=401) own mobile devices while only 0.5% of the respondents indicated that they do not own mobile devices. Among the 99.5% (n=401) respondents who own mobile devices 90.3% (n=364) have internet access on their mobile devices while only 9.5% (n=37) do not have internet access in their mobile devices. This is in exclusion of the 0.5% (n=2) respondents who indicated that they do not own mobile devices at all.

The results further depicted that 85.6% (n=345) of the respondents have sufficient memory in their mobile devices to engage in mLearning, while 14.4% (n=58) indicated that their devices do not have sufficient memory to store external files.

4.2.4.2 Skills Readiness

In terms of skills readiness or having the necessary skills to operate mLearning applications 94.8% (n=383) respondents indicated that they have necessary skills and this was noted as a positive move towards mLearning amongst the student community. However, 5.2% (n=20) indicated that they do not have necessary skills to operate mLearning applications.

4.2.4.3 Budget Readiness

A significant number of respondents 98% (n=395) indicated that they will upgrade their mobile devices if mLearning is introduced whereas only 2% (n=18) of respondents indicated that they will not upgrade their mobile devices even if mLearning is introduced in their courses. Along the same 70.7% (n=285) of respondents indicated that they do not mind paying extra costs to engage in mLearning activities while 29.3% (n=118) were reluctant to incur additional costs for mLearning purposes.

Table 4:5 Mobile learning readiness among students

		YES		NO	
	Item	Frequency	Percentage	Frequency	Percentage
Technology readiness	Device ownership	401	99.5%	2	0.5%
	Internet access	364	90.3%	39	9.7%
	Availability of memory	345	85.6%	58	14.4%
	Support Microsoft office	296	73.4%	107	26.6%
Skills readiness	Ability to download	363	90%	20	10%
	Ability to access SNS	390	96.8%	13	3.2%
	Read online news	384	95.2%	19	4.8%
	Have necessary skills	382	94.8%	20	5.2%
Budget readiness	Will incur additional costs	333	82.6%	70	17.4%
	Will upgrade mobile device	395	98%	18	2%
	Don't mind extra costs	285	70.7%	118	29.3%

4.5 THE ASSESSMENT OF MEASUREMENT MODEL

Exploratory factor analysis yielded lower factor loadings on five items from the mobile experience construct thus these items were deleted from the measurement instrument. Results from the remaining measurement indicators are depicted in appendix B.

4.6 STRUCTURAL MODEL ANALYSIS

Bivariate correlations were performed using Pearson correlations analysis. Figure 4:4 depicts statistically significant relationships on the proposed model. Appendix G indicates the results of bivariate correlations.

From the Pearson correlation analysis, it was depicted that perceived usefulness had a statistically significant correlation with perceived ease of use ($r = .377$), attitude ($r = .298$),

perceived mobility value ($r = .215$), mobile readiness ($r = .343$), behavioral intention ($r = .533$) and statistically significant correlations with perceived trust ($r = -0.336$) and perceived privacy ($r = -0.166$) were found.

Perceived ease of use had a statistically significant correlation with attitude ($r = .304$), perceived mobility value ($r = .175$), mobile readiness ($r = .361$), behavioral intention ($r = .396$). Statistically significant negative correlations were found between perceived ease of use and perceived trust ($r = -0.193$) as well as between perceived ease of use and perceived privacy ($r = -0.121$).

Attitude had a statistically significant correlation with perceived mobility value ($r = .132$), mobile readiness ($r = .192$), and BI ($r = .309$). However, ATT did not have a statistically significant correlation with PT and PP.

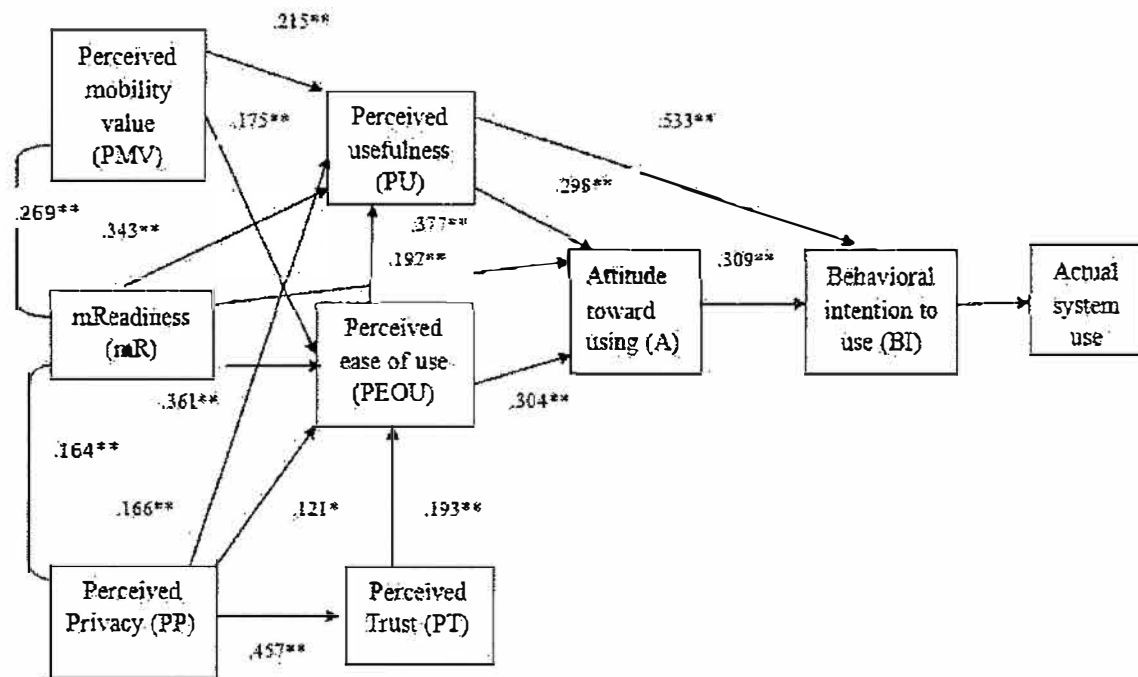
Perceived mobility value had a statistically significant positive correlations with mobile readiness ($r = .269$) and behavioral intention ($r = .259$) and a statistically negative correlation with perceived trust ($r = -0.137$). However, perceived mobility value did not have any statistically significant correlation with perceived privacy.

Mobile readiness had a statistically significant correlation with behavioral intention ($r = .437$) and a statistically significant negative correlations with perceived trust ($r = -0.348$) and perceived privacy ($r = -0.164$).

Perceived trust had a statistically significant positive correlation with perceived privacy ($r = .457$) and a statistically significant negative correlation with behavioral intention ($r = -.333$). However, no correlations were found between perceived trust and attitude.

Perceived privacy had a statistically significant negative correlations with the behavioral intention ($r = -0.122$). However, no correlation was found between perceived privacy and attitude nor was it found between perceived privacy and perceived mobility value.

Figure 4:1 Bivariate Correlations on Proposed Model

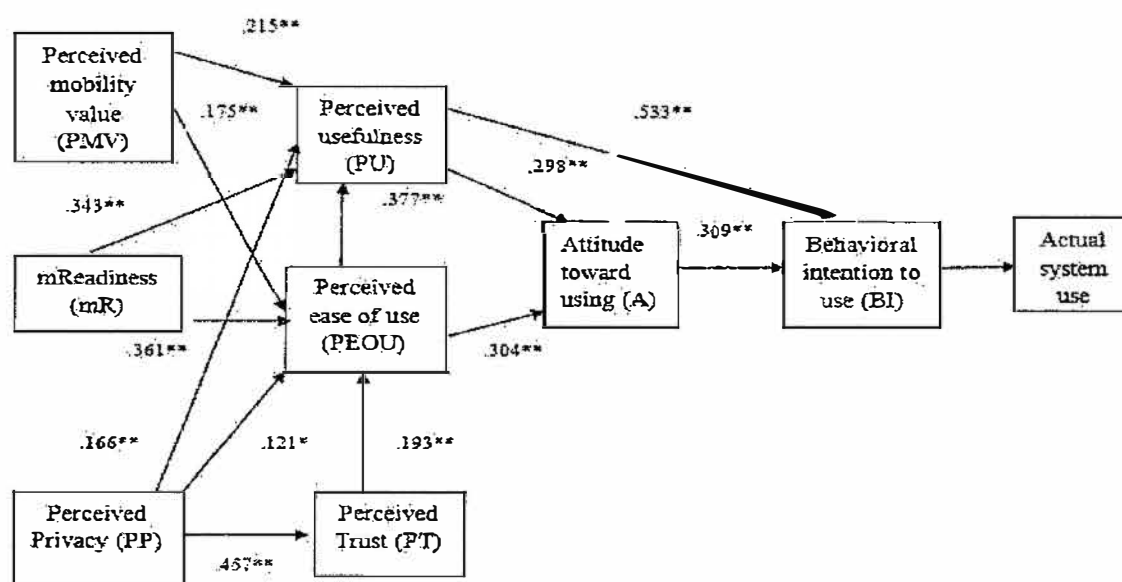


** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Based on the correlations performed the proposed model was revised (as indicated in the figure 4:5 below). The revised model was then analyzed using multiple regression and LISREL.

Figure 4:2 Mobile Learning Technology Acceptance Model (mTAM)



** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

4.7 PATH ANALYSIS USING MULTIPLE REGRESSION

Multiple regressions were conducted to test for the significant paths in the model. Table 4:4 shows the different paths tested on the model.

Table 4:6 Path Analyses using multiple regressions

Paths	Exogenous variables	Endogenous Variables
Regression Path 1	Perceived Ease of Use, Perceived Mobility Value, Mobile Readiness, Perceived Privacy	Perceived Usefulness
Regression Path 2	Perceived Mobility Value, Mobile Readiness, Perceived Privacy	Perceived Ease of Use
Regression Path 3	Perceived Usefulness, Perceived Ease of Use, Perceived Trust	Attitude
Regression Path 4	Perceived Usefulness Attitude	Behavioral Intention
Regression Path 5	Perceived Privacy	Perceived Trust

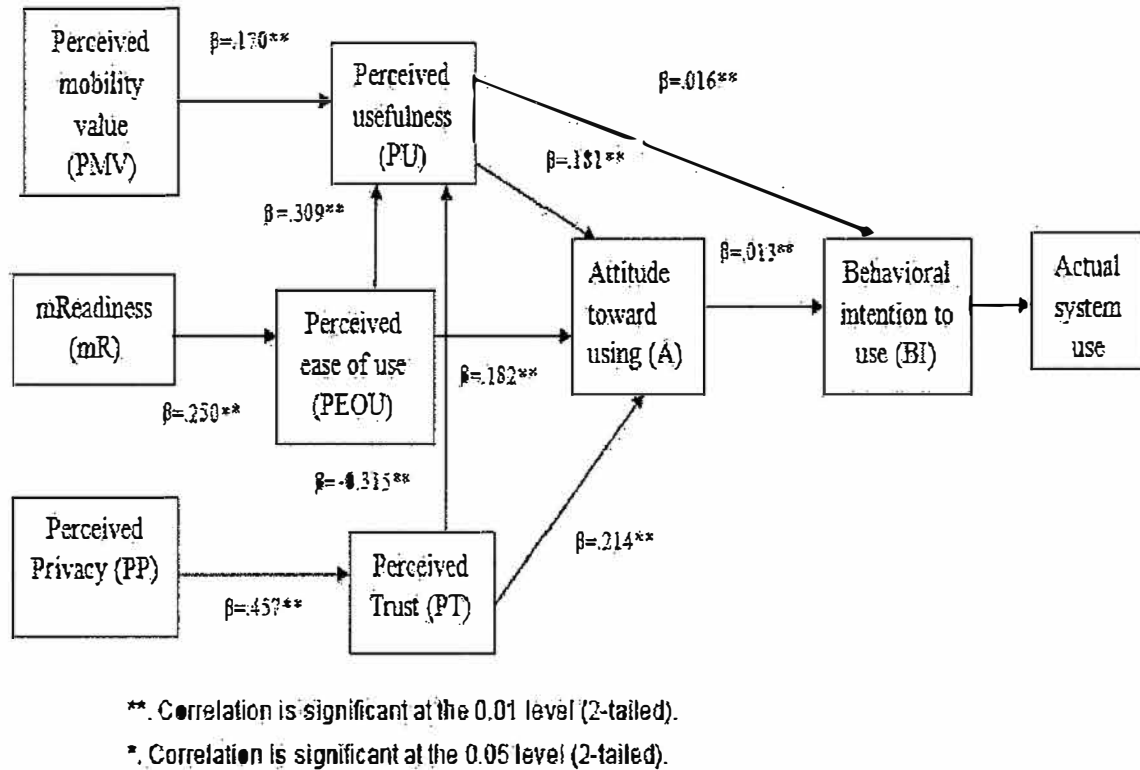
Results from path analysis indicated that path coefficients from PEOU to PU were statistically significant ($\beta=.309$, $p=.000$). The path from PMV to PU was statistically significant ($\beta=.170$, $p=.031$). The path from PT to PU was statistically significant ($\beta= -.0315$, $p=.000$). The path coefficients from MR to PU were not statistically significant ($\beta=.134$, $p=.05$). The path from PP to PU was not statistically significant ($\beta= -.013$, $p=.862$).

The path coefficients from MR to PEOU were statistically significant ($\beta=.250$, $p=.000$) whilst path coefficients from PMV, PT, PP to PEOU were not statistically significant ($\beta=.119$, $p=.093$), ($\beta= -0.65$, $p=.347$) and ($\beta= -0.054$, $p=.411$) respectively.

Path analysis depicted that path coefficients from PU to ATT were statistically significant ($\beta=.181$, $p=.000$). Similarly, paths from PEOU to ATT were statistically significant ($\beta=.182$, $p=.000$). Also, path coefficients from PT to ATT were statistically significant ($\beta=.214$, $p=.000$). Path coefficients from PU to BI were statistically significant ($\beta=.016$, $p=.000$). Paths from ATT to BI were also statistically significant ($\beta=.013$, $p=.000$).

Finally, path coefficients from PP to PU were also statistically significant ($\beta=.457$, $p=.000$). Figure 4:6 depict statistically significant paths after multiple regression analysis of the model.

Figure 4:3 Multiple Regression analysis of significant path coefficients



Based on the statistical tests performed to test for the relationships among the variables and significance path coefficients a list of supported and unsupported hypothesis was compiled. Table 4:4 below shows a list of supported and unsupported paths on the proposed model.

Table 4:7 A list of supported and unsupported hypothesis

Hypothesis	Path	Path coefficient	β	Significance level	Result
1	Perceived Mobility value --- Perceived Usefulness	.215	.170	.000	Supported
2	Perceived Mobility Value --- Perceived Ease Of Use	.175	.119	.093	Not supported
3	Mobile Readiness --- Perceived Usefulness	.343	.134	.05	Not supported
4	Mobile Readiness --- Perceived Ease Of Use	.361	.250	.000	Supported
6	Perceived Privacy --- Perceived Ease Of Use	.121	-0.054	.411	Not supported
7	Perceived Privacy --- Perceived Usefulness	.166	-0.013	.862	Not Supported
8	Perceived Privacy --- Perceived Trust	.457	.457	.000	Supported
9	Perceived Trust --- Perceived Ease Of Use	.193	-0.65	.347	Not Supported
10	Perceived Trust --- Perceived Usefulness	.182	-0.135	.000	Supported
11	Perceived Trust --- Attitude	.644	.214	.000	Supported
12	Perceived Ease Of Use --- Perceived Usefulness	.377	.309	.000	Supported
13	Perceived Ease Of Use --- Attitude	.304	.182	.000	Supported
14	Perceived Usefulness --- Attitude	.657	.181	.000	Supported
15	Perceived Usefulness --- Behavioral Intention	.533	.016	.000	Supported

4.8 THE ASSESSMENT OF MODEL

The table below shows model fit measures. The model's goodness of fit measures was within the recommended values, thus the structural model was accepted.

Table 4:8 Model fit indices

Model fit measures	Obtained values	Recommended values
Degrees of freedom	783	>0.05
RMR	.004	<.05
RMSEA	.017	<.10
GFI	.962	>.90
AGFI	.983	>.90
NFI	.935	>.90
CFI	.963	>.90
CN	70.423	>.200

4.3 QUALITATIVE RESULTS

There were five tertiary institutions sampled, however as a result of limitations in resources the group interviews were conducted at two institutions only (BIUST and Botho University). The audio recordings from group interviews were transcribed, organized and grouped into categories to support quantitative data. The main categories or emerging themes from group interviews were mobile experiences, the mobility value of mLearning, perceived privacy and security related issues. The following snippets indicate how majority of students responded during the focus group interview.

4.3.1 Mobile experience

The majority of students during group interviews agreed that since they have been using mobile applications on daily basis, the introduction of mobile technologies in education will be helpful.

"...We have been using mobile devices for so long, we know how to operate them, therefore, it will be easy for us to engage in mLearning."

"...we have programs such as WhatsApp, we have calendars, reminders in our phones. Therefore using these phones for learning purposes will be a welcome development, either for direct or indirect learning purposes." ~ University of Botswana student

They also indicated that mLearning can even support indirect learning activities. One respondent had this to say: *"The timetables for the semesters can be part of the apps so that they remind us when we have lessons, tests or examinations, mLearning can be so helpful especially to us students. Through this, it will be easy for us to track our daily activities."*

However, some students had mixed feelings regarding the use of mLearning as can be seen from responses below.

"Some of us will spend more time familiarizing ourselves with how to use this mLearning for educational purposes which could have been spent on learning."

"For us it is late to incorporate technology in education since we are used to the traditional approaches. Maybe if this could be introduced at grassroots level it will be better that way perhaps it could yield fruitful. Mobile learning will be highly beneficial to young learners at primary or secondary schools not us at this stage."

4.3.2 Perceived mobility value

Almost all groups indicated that the mobility of mLearning applications is crucial. Some of the responses were as follows:

"As long as we can get access to learning material anywhere and anytime then mLearning is useful. It is better to carry a single tablet loaded with course materials than carry a bag full of text books that you rarely read due to their heaviness, at the end of the day they will make your shoulders and back painful."

"The mobile devices can help especially during deadlines or submission of assignments as one may have the access to submit their work even from home."

4.3.3 Perceived privacy

Students were also concerned about the confidentiality of the conversation between them and their course instructors as well as between other students. Some respondents indicated thus:

"The interaction between us and instructors should be kept confidential when discussing with instructors the conversation should be private as possible so that we can feel free and confident to ask anything when we need clarity."

"Our academic data should be kept confidential so that it allows only the student who is supposed to view his/her data to do so. Some people may alter your records if they can have access to them. To every new development there are risks so we need to be assured that confidentiality will be available at all times"

4.3.4 Perceived security

Some students were concerned about the content that is loaded on these applications, indicating that they need to be assured by the relevant authorities in the school that they can boldly use the mLearning technologies for learning purposes. They emphasized on the fact that school authorities should take ownership of these technologies and not just use readymade applications which are not tailor made for their courses or programs of study, especially for course-specific applications.

"Technology is unreliable; we do not trust these applications. Who will be responsible for loading course content? Are the developers aware of what we study in school?"

"We cannot risk our studies by using unreliable sources of information. We do not want to fail and fall into the fail and discontinue trap due to silly mistakes."

"These applications are not secure at all people may edit the loaded course material or data."

"Security is not assured when using these applications, how can we be confident that the applications are reliable? As long as our instructors/lecturers can recommend the use of these mLearning applications then that's when we can use them. They should evaluate them and their applicability in our courses."

4.3.5 Mobile readiness

Majority of students indicated that they are ready in terms of the skills needed to operate mLearning technologies. However, the concern was that there is need to find out whether mLearning will work in African countries and not just to benchmark from developed

countries without looking at the available resources and infrastructure in Africa. The following were some of the student's responses:

"In Africa, we copy from western cultures; do we really think mLearning can work for us?"

"We need to consider context specific approaches which are relevant to our continent and culture. We do not have enough internet connections in our phones. The internet bundles are very expensive we cannot afford them."

"Some of us our mobile phones will not support advanced features needed by mLearning applications as we use cheap phones (mainly for calling and texting) as a result this will bring the digital divide to our communities, making the rich richer and the poor poorer. How about the less privileged members of our communities? Who do not have experience in using these phones nor own them. It will really divide us as the communities."

"Even if we have the devices it seems like it is rude to use a phone during class even when you would want to refer to the devices during the class it may seem as bad manners."

"Provided the institutions come up with a fair way of ensuring that each and every student has access to these applications through their phones then it will be applicable. There should be fairness and justice in our educational processes, we do not want a case whereby only the well-off families have access to this mLearning mainly because they can afford them. How about learners who own cheap phones (simple phones which do not have internet access, normally used for calling and sending text messages only)?"

They indicated that the issue of social justice will need to be validated to ensure that all students have equal access to mLearning technologies.

4.4 SUMMARY

This study was designed to identify the factors which influence tertiary education students in Botswana to adopt mLearning technologies. The questionnaire provided data on the attitudes and perceptions of students towards mLearning. The data was used to develop a mLearning adoption model employing TAM as the theoretical framework.

Focus group interviews conducted on the preliminary stages of the study served as the foundation for the study. This is so because the output from the focus group interviews was used as the input data to quantitative data analysis.

CHAPTER 5: DISCUSSION OF RESULTS

5.1 INTRODUCTION

This chapter presents the discussion of results. It describes the significance of the research results in relation to the existing literature to justify whether the new data supports or contradicts the existing literature.

5.2 ANSWERS TO RESEARCH QUESTIONS

5.2.1 Research Question 1: What is the level of mLearning readiness among tertiary students in Botswana?

As has been depicted by the results of this investigation, it is evident that most of the students are ready for mLearning in terms of technology ownership, skills and budget readiness. However, a significant number of respondents were reluctant to incur additional costs in order to engage in mLearning activities. The issue of budget when considering deployment of mLearning should be emphasized. These findings are consistent with Adedoja et al. [27] and Hussin et al. [18] that in terms of financial costs students are reluctant to spend extra costs on mLearning activities. Therefore as suggested by Koch and Van Brakel [26] the use of non-paying mobile services should be adopted including readily available mobile applications such as SMS and Bluetooth to cover for the concern on additional costs. Similarly, tertiary education institutions should liaise with network providers to provide free data packages so that they can access the educational content via mobile devices [27]. This can be beneficial as students are not willing to incur additional costs on mLearning.

Findings also indicated that mobile device ownership amongst tertiary education students stood at 99.5%. As such the mobile device ownership showed that students are ready for mLearning. However, the fact that some portion of the student community does not have mobile devices should not be overlooked when implementing mLearning technologies, such ignorance has potential to bring a digital divide between the students who own mobile devices and those ones who do not own mobile devices. This can widen the gap between the have and have not. These findings are consistent with Laouris and Eteokleous [24] that mLearning is a potential actor in the digital divide.

5.2.2 Research Question 2: What are the factors which influence mLearning adoption in Botswana?

Findings have indicated that both key determinants of TAM (Perceived Usefulness and Perceived Ease of Use), external variables (Perceived Mobility Value, Mobile Readiness, Perceived Privacy and Perceived Trust) and attitude influence behavioral intention of students to adopt mLearning technologies. This implies that even in the context of developing countries when planning to adopt mLearning technologies this factors needs to be taken into consideration so as to increase the adoption rates or acceptance amongst the students' community. Previous findings confirm this finding that these factors are crucial in predicting behavioral intention to adopt mLearning technologies. Huang [56], Park, Nam and Cha [53] confirm that attitude is an essential factor in influencing behavioral intention to adopt mLearning technologies. Similarly Huang [56] affirms that Perceived Mobility Value is a crucial and sensitive factor in influencing the behaviour of tertiary education students to adopt mLearning technologies.

However, in a similar study Liu, Li and Carlsson [54] concluded that perceived ease of use and perceived usefulness are not significant at all in predicting behavioral intention of students to adopt mLearning technologies. This argument contradicts with the current findings.

5.2.3 Research Question 3: What are the relationships among external variables, key determinants, attitude towards using and intention to adopt mLearning?

The figure below shows a mathematical representation of the relationships among external variables, key determinants, and behavioural intention.

$$BI = A + PU$$

$$A = PEOU + PU + PT$$

$$PU = PMV + PEOU + PT$$

$$PEOU = mR$$

In this study, it was found out that behavioral intention was measured from measures of attitude and perceived usefulness. This means that behavioral intention to adopt mLearning is influenced or affected by attitude and perceived usefulness only. Findings as such

confirm previous literature on TAM that behavioral intention can be predicted by attitude and perceived usefulness only [12] [43] [56]. This implies that educators need to develop a positive attitude on students as well as sensitize them with the usefulness of mLearning to help increase acceptance of these technologies. The findings indicate that attitude is a key factor in influencing behavioral intention. In the same way, Park et al. [53] and Huang et al [56] found that attitude is a key factor in influencing behavioral intention. Conversely, Fadare [34] argued that attitude is a less determinant of behavioral intention to use mLearning applications.

The results indicate that attitude is determined by perceived ease of use, perceived usefulness and perceived trust. The implications of the findings are that if mLearning technologies are easy to use students may develop a positive attitude towards using mLearning technologies. Similarly if students perceive mLearning technologies as useful they may develop a positive attitude as well.

In this study, it was found that perceived trust has a significant contribution to attitude as compared to perceived usefulness and perceived ease of use. This means that if students trust the content in these mLearning applications they may develop a positive attitude towards using them. This denotes that in order for students to develop a positive attitude to mLearning the issue of trust has to be considered during the processing of developing and rolling out of technologies. These findings are consistent with existing literature that trust plays a significant impact on behavioral intention to adopt a certain information system [87] [88]. Gefen et al. [87] found that trust in TAM model is as important as perceived usefulness and perceived ease of use, emphasizing that together these variables set explain a considerable proportion of variance in intended behavior. Although the context was online shopping, the findings are as well consistent in the mLearning context as depicted in this study. Therefore the mLearning applications need to be trustworthy so that students can develop a behavioral intention to adopt these technologies. As a result to increase mLearning acceptance there is a need to develop trust for mLearning applications amongst the student community. In addition, the results indicate that trust in mLearning technologies is more important than perceived usefulness and perceived ease of use. Therefore educators should develop the trust of students about applications in order to increase intention to use. Trust can be established by encouraging mLearning developers to develop reliable and trustworthy applications that can protect users' confidential data.

In the same way, perceived ease of use determined attitude with a higher degree as opposed to perceived usefulness. The findings are similar to what was found by Liu et al [54]. This implies that policy makers and developers have to develop mLearning technologies that are easy to use in order to enable students to accept them. As such findings of this study contradicts the results found by Khanh et al. [76] that perceived ease of use has no significant effect on attitude, emphasizing that mLearning technologies are not easy to use attributing this to technology restrictions such as small screen size.

In this study, a significant relationship between perceived usefulness and perceived mobility value was found. It therefore means that if students recognize the mobility value of mLearning technologies they may, in turn, perceive them as useful. Hence students need to be reminded about the importance of the mobile aspect of mLearning technologies continuously as it would help in increasing acceptance as they would consider them useful. Also, Huang et al. [56] emphasized that PMV is a crucial factor in predicting behavioral intention to adopt mLearning. Conversely, Khanh [10] argued that perceived mobility value does not affect perceived usefulness in any way. Khanh [10] emphasized on the fact that awareness of mobility for usefulness is a truism because users are always aware that mobility is useful in most cases including mLearning.

The predictors of perceived usefulness were perceived mobility value, perceived ease of use and perceived trust. The external variables mobile readiness and perceived privacy did not have a direct effect on perceived usefulness. This brings an interesting argument as it was theorized in the original TAM that the external variables have a direct and indirect effect on perceived usefulness [43]. Mobile readiness influenced perceived usefulness indirectly through perceived ease of use. Similarly, perceived privacy influenced perceived usefulness indirectly through PT. These results are inconsistent with what was found by Davis et al [43] that external variables affect perceived usefulness directly and indirectly through perceived ease of use.

Perceived trust was found to be the most influential predictor of perceived usefulness, although the influence was negative. This clearly indicates that if students consider mLearning technologies trustworthy they would, in turn, consider them useful to their learning process. This implies that educators need to ensure that the mLearning technologies are best suited to the needs of the students and will help them to improve their

learning or academic performance. Sensitizing students as well about these applications may help students to develop some trust in these technologies and thus, in turn, consider them useful in their day to day learning activities.

The findings indicate that perceived ease of use was influenced by mobile readiness only. From the original theorized TAM it was indicated that the external variables influenced perceived ease of use directly as well. However, it was found that the only variable that influenced perceived ease of using mLearning technologies directly was mobile readiness. This finding challenges what was found in the previous literature. As a matter of fact, it implies that if students are ready in terms of having relevant technologies, skills and money to engage in mLearning they would perceive mLearning technologies easy to use. Therefore various tertiary institutions should ensure that the students are ready to engage in mLearning before actual implementation of mLearning technologies.

5.2.4 Research Question 4: Which variables are most influential in predicting intention to use mLearning?

On the question of variable most influential in predicting intention to use mLearning, findings depicted that the key determinants in explaining behavioral intention to adopt mLearning are attitude and perceived usefulness. This means that if students understand the importance and need of mLearning technologies they may intend to use those applications to support their day to day learning activities and needs. Moreover if students embrace a positive attitude towards mLearning technologies they may as well use those technologies fruitfully in their educational advance. Similarly Park, Nam and Cha [53] and Huang and Lin [56] confirm that attitude is a key variable in predicting behavioral intention to adopt mLearning technologies. This is indicative that to increase adoption of mLearning technologies amongst students' community, a positive attitude towards mLearning needs to be encouraged and developed on the students. Likewise, more effort is needed towards sensitization of students on the usefulness and importance of mLearning. It is clear that the more students recognise the usefulness of mLearning technologies the more they are likely to adopt such technologies.

Conversely Fadare et. al [34] argued that attitude is a least determinant in predicting behavioral intention to adopt mLearning technologies. This finding is dissimilar with the current findings. The implications of Fadare et. al [34] are that even if students do not hold

a positive attitude towards mLearning they can still adopt mLearning technologies. This may be applicable in an environment where the usage of mLearning technologies is mandatory amongst the student body, meaning that non-compliance may disadvantage students somehow.

5.2.5 Research Question 5: What are the practical or theoretical implications of the research findings?

The proposed model is consistent with the actual data as depicted by model fit indices. This implies that the gathered data fit into the model, that is the model explains the behavioral intention of students in adopting mLearning. It also indicates that the application of TAM in the context of mLearning is suitable and applicable. The model has explained 61% in behavioral intention to adopt mLearning among tertiary students. The improvement from 40% from the original TAM clearly indicates that TAM is a suitable model when applied in various settings to identify, explain or predict adoption or acceptance of a particular information system. It is, therefore, evident that TAM is the appropriate model to use when it comes to adoption of information systems.

The findings of this research indicates that in terms of budget readiness the implementation of mLearning technologies in tertiary institutions is unfavourable since students are not willing to incur additional costs to engage in mLearning activities. However, this does not imply that mLearning is not applicable, as cost effective features which does not require money can be utilized when developing mLearning technologies. Therefore policy makers in institutions who are responsible for acquiring mLearning technologies should work closely with the developers to consider this issue during actual development. Cost effective features such as camera, SMS, MMS and Bluetooth can be utilized.

5.3 CONSOLIDATION OF QUANTITATIVE AND QUALITATIVE DATA RESULTS

The research design was developmental in nature, that is qualitative study was conducted on the preliminary stages of the study. The output of the qualitative study was used as input data to the quantitative study. Basically, qualitative study was used to develop constructs and hypothesis and quantitative study was conducted to test the hypothesis.

The results from qualitative study showed that the external variables or factors which influence tertiary education students to adopt mLearning technologies are mainly mobile readiness, perceived privacy, perceived trust, perceived security, mobile experience and perceived mobility value. Both qualitative and quantitative studies found that perceived privacy, mobile readiness, perceived trust and perceived mobility value are essential variables in influencing behavioral intention to adopt mLearning technologies. The findings from both studies complemented each other. However, quantitative analysis indicated that perceived security and mobile experience does not influence tertiary education students to adopt mLearning technologies. The findings from the quantitative instruments contradict findings from the qualitative. This is interesting, contradictory findings in the same study. Venkatesh, Brown and Bala [61] indicated that when conducting mixed method approach it is familiar that a researcher may find different (contradictory and complementary) conclusions from the quantitative and qualitative approaches. The divergent findings in mixed method approaches are valuable in that they enrich understanding of a phenomena as they open new avenues and questions for future research [61].

5.4 CHAPTER SUMMARY

The chapter discussed the research findings in relation to the existing literature, indicating whether the current findings confirms or contradicts existing knowledge on mLearning adoption. The implications of the research findings are also highlighted to depict the meaning of findings.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter mainly provides major conclusions of the study. Firstly it provides a summary of the overall study. Secondly, conclusions are drawn based on the research findings. Thirdly the recommendations to tertiary institutions willing to implement mLearning technologies are made as well as future research directions. Finally, the limitations of the overall study are highlighted.

6.2 SUMMARY OF THE STUDY

The purpose of this study was to determine the factors which influenced tertiary students to adopt mLearning technologies. To accomplish this it was crucial to achieve some prerequisite objectives to analyze the key determinants of mLearning. Related to that, it became necessary to determine the level of readiness among students as well as to develop a model for mLearning adoption using TAM as the theoretical framework. It was also deemed appropriate to validate the developed model. Once these fundamental steps were achieved, the research was deemed successful. This chapter reports the conclusions and recommendations that resulted from the study.

6.3 CONCLUSIONS

The study was aimed at identifying the factors which influenced adoption of mLearning using TAM as the theoretical framework. It was found that Perceived usefulness and Attitude are the key determinants of mLearning adoption among students. This implies that it is vital to sensitize students on the usefulness of these mLearning technologies before actual adoption. This can also help students to develop a positive attitude towards adopting these mLearning technologies and have an ownership of the initiative. Perceived trust was also found to be a crucial indicator of attitude, implying that developers or tertiary institutions should consider the issue of trust when developing mLearning applications to be used by students. The model has explained 61% in behavioral intention to adopt mLearning among tertiary students. The improvement from 40% from the original TAM clearly indicates that TAM is a suitable model when applied in various settings to identify, explain or predict adoption or acceptance of a particular information system. It is, therefore, evident that TAM is the appropriate model to when it comes to adoption of

information systems. However, it is crucial for future studies to consider all relevant and context specific attributes of mLearning to allow TAM to expand and explain the maximum percentage of behavioral intention to adopt mLearning technologies.

The policy makers in various tertiary institutions charged with the responsibility of acquiring mLearning technologies for use in the institutions should thus sensitize students on the usefulness of mLearning technologies. It can also help students to develop a positive attitude towards these technologies and thus use them in their day to day learning activities. The mLearning applications should be easy to use to enable students to use them more effectively so they would not require a lot of mental effort to use them. Developing easy to use applications will increase usage of these technologies.

6.4 RECOMMENDATIONS

In the light of the pervasive influence of the findings from this study recommendations are made aimed at tertiary institutions.

Recommendations for tertiary institutions

Based on the findings of the study, the following recommendations were made for efficient implementation of mLearning among tertiary institutions:

The learning management systems in various institutions should be developed in a way that supports the view in mobile platforms. Also, different tertiary institutions should liaise with network providers to provide packages to students to allow access to mLearning technologies at a free or reasonable cost. The various tertiary institutions should collaborate and develop an mLearning laboratory that would help in the development of course-specific mLearning applications or technologies.

Future work

The findings indicate self-reported usage of mLearning hence there is a need to validate with actual mLearning applications. There is a need to determine the pedagogical implications of mLearning to the students in order to identify the approaches/subjects best suited for mLearning. Also, there is a need to develop a mLearning theory that incorporates all the aspects and dimensions of mLearning because mLearning encompasses a broad field of educational technology.

The effect of institutional policies and infrastructure on adoption of mLearning should be assessed and examined as it provides a supporting environment for students. Similarly, the socio-economic status of students, as well as design-specific attributes influencing adoption of mLearning, should also be studied. There should also be a standardized model or framework to assess mLearning readiness among students in order to enable various tertiary institutions to rate their students before the adoption of mLearning technologies in order to ensure successful implementation. It will also provide a room for improvement to ensure successful adoption of mLearning. Lastly, future studies may also employ the use of data mining tools to uncover the hidden patterns that exist among the factors that influence behavioral intention to adopt mLearning.

6.5 LIMITATIONS

The findings reported self-reported usage not actual usage, therefore the findings may need validation with the actual implementation of mLearning technologies. From the findings, it is expected that some students have no experience of mLearning technologies, as a result, they will use their perceptions to show their responses when answering the questionnaire. Due to limited resources, the group interviews were conducted in two tertiary institutions only, namely: Botho College and BIUST, thus the findings cannot be generalized to all sampled tertiary institutions.

6.6 CHAPTER SUMMARY

The chapter concluded the study. The conclusions drawn were based on the findings of the research. The recommendations for mLearning deployment as well as future research direction were made. The chapter concluded with the limitations encountered during the study.

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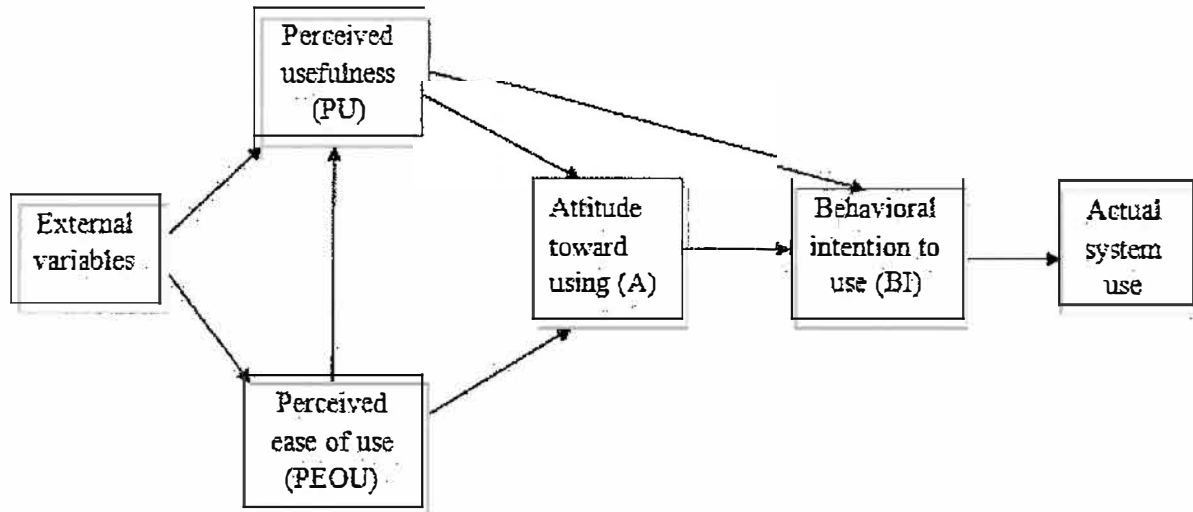
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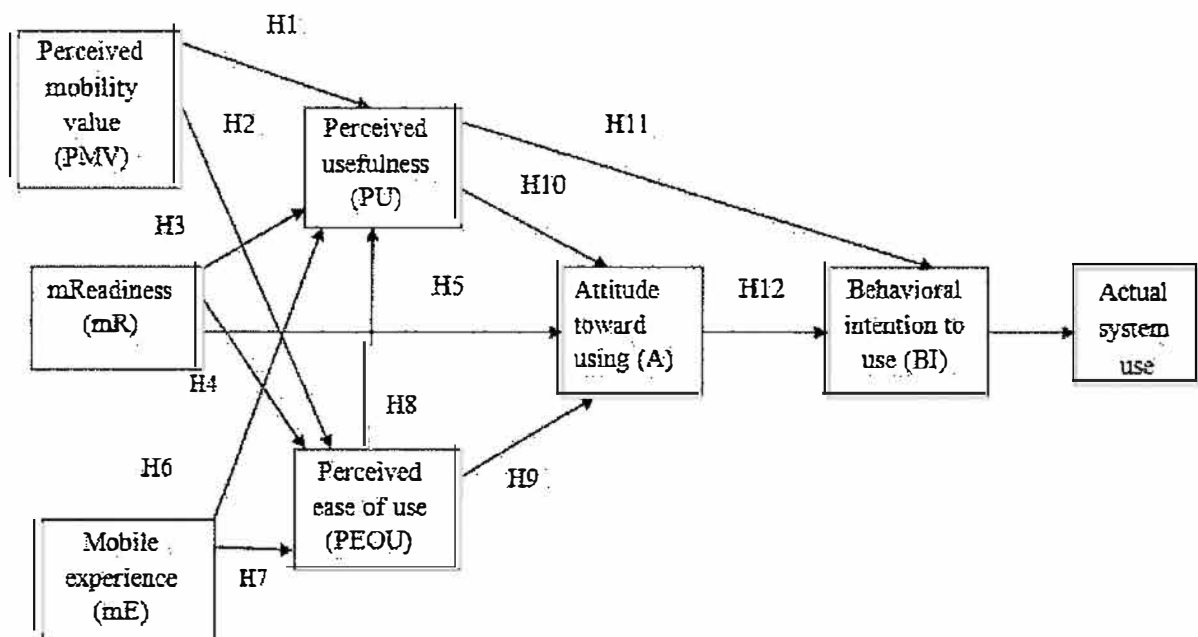
APPENDICES

APPENDIX A: EVOLUTION OF THE PROPOSED MODEL

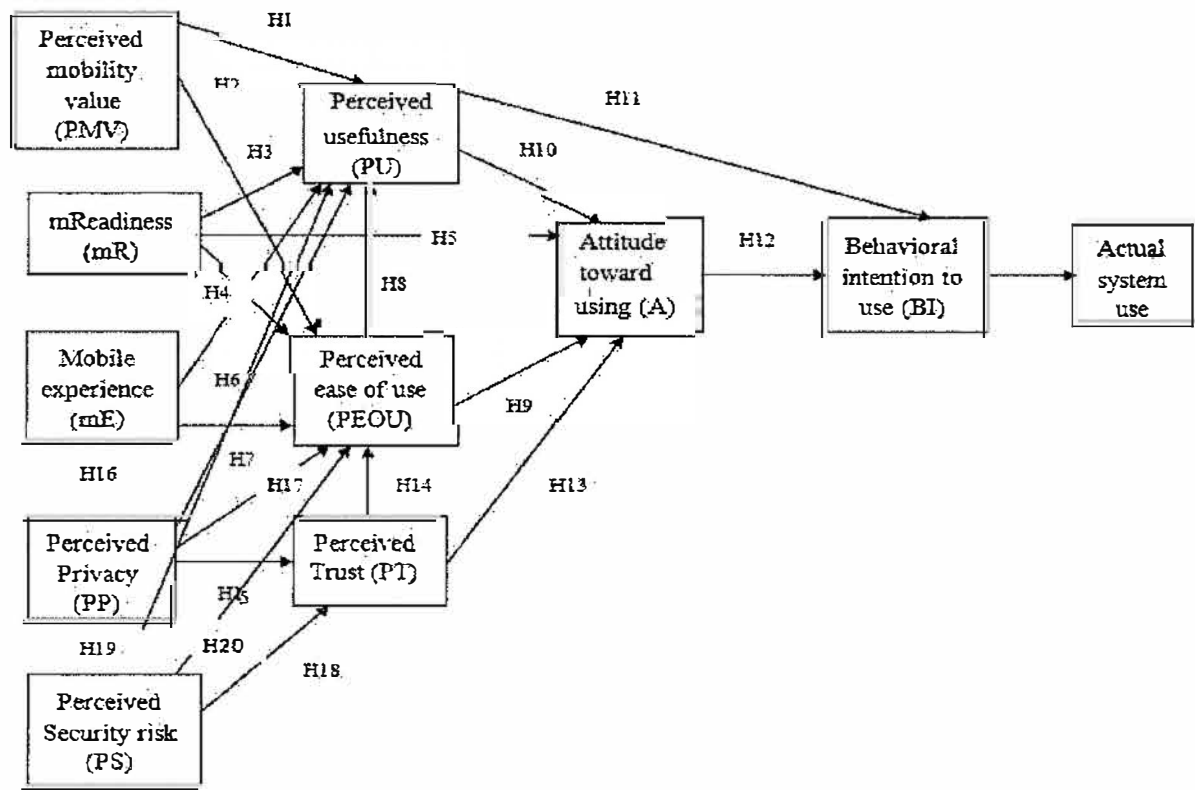
1. TAM: Technology Acceptance Model



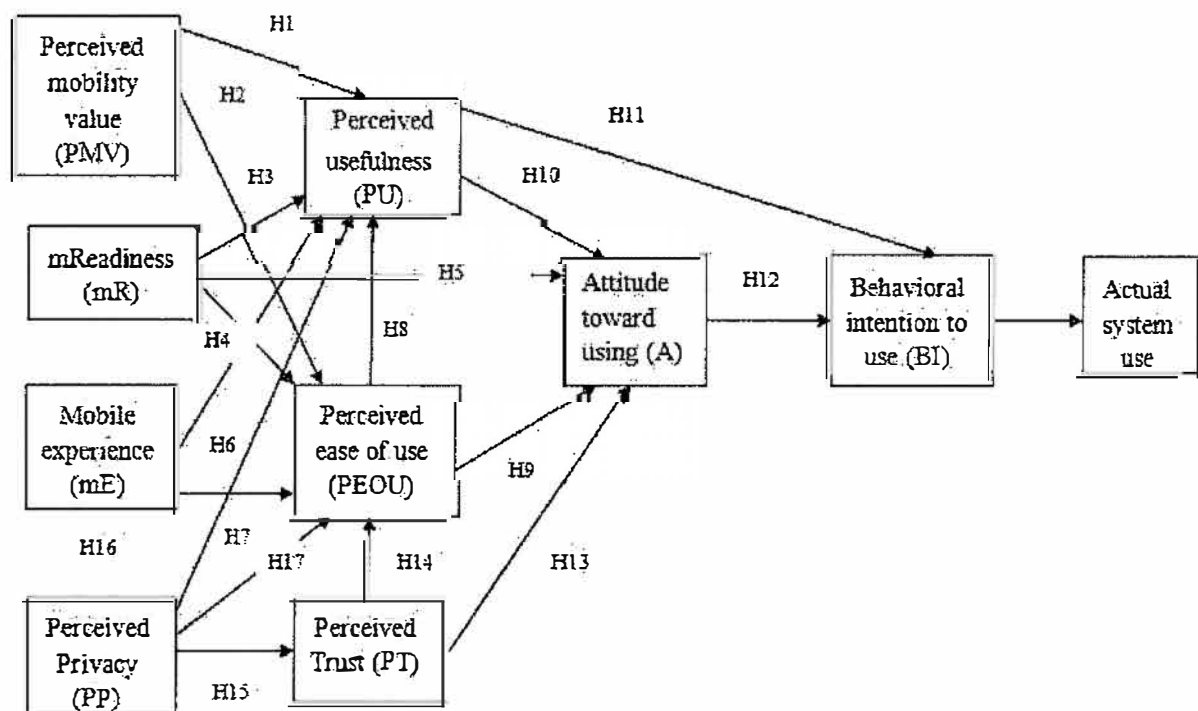
2. Original Proposed Model



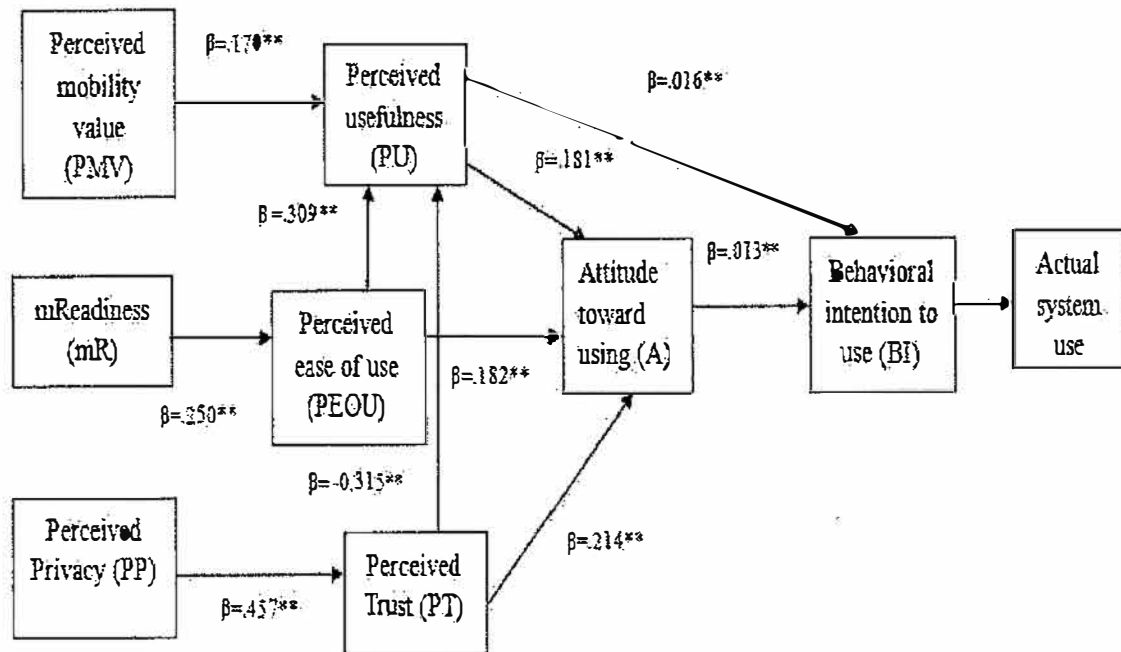
3. Proposed Model after preliminary interviews with students



4. Proposed Model after Pilot Study



5. Final mLearning Technology Acceptance Model



** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

APPENDIX B: RELIABILITY ANALYSIS OF PILOT STUDY

The questionnaire was pilot tested to 30 students in Botswana International University of Science and Technology (BIUST). 30 questionnaires were issued but only 27 were returned, indicating a response rate of 90% rate. The table below shows results of the reliability tests.

Reliability analysis of pilot study

Construct	Number of Items	Mean	Cronbach' s alpha
Perceived Usefulness (PU)	6	1.786	.922
Perceived Ease Of Use (PEOU)	7	1.933	.895
Attitude	5	2.726	.764
Behavioral Intention	3	2.272	.915
Perceived Mobility Value (PMV)	3	2.025	.918
Technology Readiness (TR)	11	1.762	.829
Mobile Experience (ME)	5	1.644	.871
Perceived Trust (PT)	3	3.885	.776
Perceived Privacy (PP)	3	2.474	.829
Perceived Security (PS)	3	1.753	.020

APPENDIX C: QUESTIONNAIRE



Botswana International University of Science and Technology

PREDICTIVE MODEL FOR MOBILE LEARNING ADOPTION AMONG TERTIARY EDUCATION STUDENTS IN BOTSWANA

This questionnaire is part of a research project to locate the factors which influence Tertiary Education Students in adopting Mobile Learning (mLearning) applications. The responses provided will be used as the main data set for the research project.

Definition: Mobile learning (mLearning) refers to the use of mobile devices for learning purposes.

Thank you for your help in advance.

SECTION A: DEMOGRAPHICS

Instruction: Tick in the appropriate box.

1. Age ☐ Less than 20
☐ 20 - 25
☐ 26 - 30
☐ 31 & above

2. School ☐ Botho
☐ BIUST
☐ Limkokwing
☐ UB

3. Year of study ☐ Year 1
☐ Year 2
☐ Year 3
☐ Year 4
☐ Year 5 +

4. Gender ☐ Male
☐ Female

5. Do you have a mobile device/phone? ☐ YES ☐ NO
6. Have you used your mobile device to support learning? ☐ YES ☐ NO

SECTION B: PERCEIVED USEFULNESS

Instruction: The statements below refer to whether mobile learning can enhance student's performance and learning. Please read each statement carefully, and then circle only one answer for each statement.

1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. mLearning will improve the quality of learning	1	2	3	4	5
2. mLearning will enable me to accomplish school tasks more quickly	1	2	3	4	5
3. mLearning will improve my learning and achievement	1	2	3	4	5
4. mLearning will make learning easier and comfortable	1	2	3	4	5
5. mLearning will enable me to accomplish learning tasks quickly	1	2	3	4	5
6. Overall I find mLearning useful	1	2	3	4	5

SECTION C: PERCEIVED EASE OF USE

Instruction: The statements below refer to whether mobile learning will be easy to use.

1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. mLearning apps will be easy to use	1	2	3	4	5
2. Learning to operate mLearning apps will be easy for me	1	2	3	4	5
3. It will be easy for me to remember how to perform tasks using mLearning apps	1	2	3	4	5
4. Interacting with mLearning will be clear and understandable	1	2	3	4	5
5. Interacting with mLearning apps will require a lot of mental effort	1	2	3	4	5
6. It takes a lot of effort to become skilful in using mLearning apps	1	2	3	4	5
7. Overall, mLearning apps will be easy to use	1	2	3	4	5

SECTION D: ATTITUDE

Instruction: The statements below refer to your attitude towards mobile learning.

1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. It would be very desirable to use mLearning apps	1	2	3	4	5
2. I would like to use mLearning	1	2	3	4	5
3. mLearning apps will make me feel more confused	1	2	3	4	5
4. mLearning technologies complicates the learning process	1	2	3	4	5
5. I hold a positive evaluation of mLearning	1	2	3	4	5

SECTION E: BEHAVIORAL INTENTION

Instruction: The statements below refer to your behavioral intention towards using mobile learning.

1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. I intend to use mLearning when it becomes available	1	2	3	4	5
2. If I were asked to express my opinion of mLearning, I intend to say something favourable	1	2	3	4	5
3. In future I intend to use mLearning routinely	1	2	3	4	5

SECTION F: PERCEIVED MOBILITY VALUE

Instruction: The statements below refer to your perception towards mobility value of mobile learning. 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. It is convenient to access mLearning anywhere, anytime	1	2	3	4	5
2. It allows real time access to data	1	2	3	4	5
3. Overall, mobility is a crucial aspect of mLearning	1	2	3	4	5

SECTION G: MOBILE READINESS

Instruction A: The statements below refer to your basic readiness towards adoption of mobile learning.

Item	YES	NO
1. Does your mobile device have internet access?	1	2
2. Does your mobile device support 3G or 4G?	1	2
3. Does your mobile device have a memory card?	1	2
4. Does your mobile device supports Microsoft Office tools?	1	2

Instruction H: Please read each statement carefully, and then circle only one answer for each statement. 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5. I can download and access files from internet using mobile device?	1	2	3	4	5
6. I am capable of accessing Social Network Sites via mobile devices	1	2	3	4	5
7. I am capable of reading news online via mobile devices	1	2	3	4	5
8. I have necessary skills to operate mLearning applications	1	2	3	4	5
9. I am willing to incur additional costs for mLearning	1	2	3	4	5
10. I will upgrade my mobile device if mLearning is reduced	1	2	3	4	5
11. I don't mind paying extra money for mLearning	1	2	3	4	5

SECTION I: MOBILE EXPERIENCE

Instruction: The statements below refer to your previous mobile experience of using mobile applications. 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Search for information online	1	2	3	4	5
2. Communicate through email/chat	1	2	3	4	5
3. Watch video	1	2	3	4	5
4. Listen to audio files	1	2	3	4	5
5. Download softwares	1	2	3	4	5

SECTION J: PERCEIVED TRUST

Instruction: The statements below refer to your overall trust on using mobile applications.
1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. I do not trust mLearning applications	1	2	3	4	5
2. mLearning apps are not reliable	1	2	3	4	5
3. My opinion about trusting mLearning apps with my academic records is negative	1	2	3	4	5

SECTION K: PERCEIVED PRIVACY

Instruction: The statements below refer to your privacy concerns of using mobile applications.
1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. My academic information might be exposed	1	2	3	4	5
2. Hackers may alter my online academic records	1	2	3	4	5
3. If I loose my phone, my marks won't be kept confidential.	1	2	3	4	5

APPENDIX D: INTERVIEW QUESTIONS FOR GROUPS

1. Have you had experience with mobile technologies before? How was it?
 - a) How do you use your mobile device? Are there any applications you do not understand or do not find useful?
 - b) Do you prefer a cell phone or laptop to use for learning purposes? Why?
2. What mobile applications do you like? Why?
3. What mobile applications do you dislike? Why?
4. Have you been engaged in mLearning before?
 - a) Do you see yourself using mobile device for learning purposes? For doing what specifically?
 - b) What do you think about mLearning? Do you like OR dislike? Why?
5. How did you personalise your mobile device to support your learning goals? What apps have you installed?
6. If mLearning is implemented where do you see yourself using the device most commonly? Why?
7. What do you think are the concerns OR challenges for using mobile devices for learning purposes?

APPENDIX F: ANALYSIS OF COLLINEARITY STATISTICS

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.642	.679		.947	.344		
	PU	.168	.024	.327	7.003	.000	.711	1.407
	PEOU	.067	.027	.112	2.473	.014	.761	1.314
	ATT	.113	.035	.140	3.207	.001	.809	1.236
	PMV	.060	.036	.068	1.648	.100	.904	1.106
	MR	.079	.022	.165	3.596	.000	.734	1.362
	PT	-.138	.037	-.185	-3.761	.000	.640	1.562
	PP	.041	.033	.055	1.246	.213	.787	1.270

a. Dependent Variable: sumBi

APPENDIX G: CORRELATION MATRIX OF VARIABLES

Correlations									
		Perceived Usefulness (PU)	Perceived Ease of Use (PEOU)	Attitude (ATT)	Perceived Mobility Value (PMV)	Mobile Readiness (MR)	Perceived Trust (PT)	Perceived Privacy (PP)	Behavioral Intention (BI)
Perceived Usefulness (PU)	Pearson Correlation	1	.377**	.298**	.215**	.343**	-.336**	-.166**	.533**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.001	.000
	N	394	394	394	394	394	394	394	394
Perceived Ease of Use (PEOU)	Pearson Correlation	.377**	1	.304**	.175**	.361**	-.193**	-.121*	.396**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.016	.000
	N	394	394	394	394	394	394	394	394
Attitude (ATT)	Pearson Correlation	.298**	.304**	1	.132**	.192**	.088	.006	.309**
	Sig. (2-tailed)	.000	.000		.008	.000	.081	.908	.000
	N	394	394	394	394	394	394	394	394
Perceived Mobility Value (PMV)	Pearson Correlation	.215**	.175**	.132**	1	.269**	-.137**	-.027	.259**
	Sig. (2-tailed)	.000	.000	.008		.000	.006	.592	.000
	N	394	394	394	394	394	394	394	394
Mobile Readiness (MR)	Pearson Correlation	.343**	.361**	.192**	.269**	1	-.348**	-.164**	.437**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.001	.000
	N	394	394	394	394	394	394	394	394
Perceived Trust (PT)	Pearson Correlation	-.336**	-.193**	.088	-.137**	-.348**	1	.457**	-.333**
	Sig. (2-tailed)	.000	.000	.081	.006	.000		.000	.000
	N	394	394	394	394	394	394	394	394
Perceived Privacy (PP)	Pearson Correlation	-.166**	-.121*	.006	-.027	-.164**	.457**	1	-.122*
	Sig. (2-tailed)	.001	.016	.908	.592	.001	.000		.015
	N	394	394	394	394	394	394	394	394
Behavioral Intention (BI)	Pearson Correlation	.533**	.396**	.309**	.259**	.437**	-.333**	-.122*	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.015	
	N	394	394	394	394	394	394	394	394

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).