ADOPTION OF MOBILE LEARNING AT THE UNIVERSITY OF TECHNOLOGY IN SOUTH AFRICA

by

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DECLARATION

I, Motsotua Confidence Hlatshwayo, hereby declare that the work, which is submitted here, is the product of my own independent research and that all the sources I have used and quoted have been pointed out and acknowledged by means of a complete reference list. In addition, I declare that the work is submitted for the first time at this university/faculty towards the Magister Technologiae (MTech) degree in the Information Technology Department and that it has never been submitted to any other university/faculty for the purpose of obtaining a degree.

ABSTRACT

The influence of Information and Communication Technology (ICT) in the education system has encouraged both students and educators to become more and more computer literate. With the increased use of portable devices (tablets, PDAs, Smartphones, iPads etc.), mobile learning (m-learning) has gained popularity as it is believed to be an effective and efficient tool for content presentation and knowledge acquisition in education sector. The realisation of the benefits depends on the effective adoption of m-learning technology. The superseding purpose of this study was to investigate the adoption of mobile learning at a University of Technology (UoT) in South Africa. A quantitative study was carried out at an UoT in South Africa, with respect to mobile learning perceptions; 64 valid questionnaires were received from the participants. The proposed research framework/model derived from Extended Technology Acceptance Model (ETAM) and Technology Acceptance Model 3 (TAM3) was used. The Statistical Package for the Social Sciences (SPSS), version 25.0. was used for analysing data. The findings revealed that perceived usefulness of mobile learning, attitude toward mobile learning, service and system quality as well as perceived ease of use are significant predictors of intention to use mobile learning application. Perceived mobility on mobile learning strongly influences perceived usefulness more than perceived ease of use of mobile learning application. The study concluded that it is necessary to measure perception of potential users using the variables in the model proposed before adoption of mobile learning application to ascertain an effective adoption of the technology in education.

Keywords: students, educational supporting tool, mobile learning, higher education institutions (HEIs), E-learning

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CHAPTER 1

INTRODUCTION

1.1. INTRODUCTION AND BACKGROUND

Mobile learning is defined as learning facilitated by mobile devices such as tablet, personal computers (PCs), Smartphones and Personal Digital Assistants (PDAs) (Herrington & Herrington 2007; Valk *et al.* 2010; Abu-Al-Aish & Love 2013) in both formal and informal education. The extensive use of portable, wireless and mobile devices has shifted the scene of technology-supported learning (Han and Han, 2014). With the advances of the Internet and mobile technologies came challenges as well as opportunities to teaching and learning. Therefore, to address the needs of the digitally-oriented generation of students, many higher education institutions have made efforts to develop mobile applications for academic, social and administrative support to provide effective learning experiences (Tshabalala *et al.* 2014).

Mobile learning applications increase accessibility to learning contents and activities (Vicente, 2013). The potential benefits of mobile learning (Vicente, 2013) have been extensively advertised from a range of purposes, including cost savings, global communications, study aids and location-based services (Cheon *et al.* 2012, Gikas and Grant, 2013). Mobile device applications can be utilised as study support that students can access from anywhere. However, the realisation of these benefits depends on the adoption of m-learning. The mere availability of mobile devices does not guarantee their use in education.

1.2. PROBLEM STATEMENT

Studies have shown that the use of mobile devices was for some time limited to additional functions to the regular learning processes, such as educators using social media applications and students engaging in online interaction with their peers (Hoffman, 2013,

Gikas and Grant, 2013). However, students require more than just functions that partly improve learning activities; they want to access reading materials, communicate with educators, discuss and access course material (Cheon et al. 2012). Such activities are mostly provided through learning management systems (LMS) available on the Web and are accessed with computers. While existing mobile technologies can help meet some of the needs of the students for improved access to course material through mobile devices, the realisation of m-learning benefits depends on the adoption of m-learning. However, if adopted without all factors considered it may result in low acceptance levels, minimal usage and/or even wasted investment. Very few studies have been done to investigate factors that influence the adoption of mobile learning management systems (Han and Han, 2014).

1.3. PURPOSE OF THE STUDY

The purpose of this study is to explore factors that affect the successful adoption of mobile learning at a Universities of Technology (UoT).

1.4. RESEARCH QUESTIONS

The research questions that will be addressed are stated as follows:

- What is the effective framework for the adoption mobile learning at UoT?
- To what extent do the mobile learning adoption factors correlate with each other?
- To what extent do the mobile learning adoption factors influence each other?

1.5. RESEARCH OBJECTIVES

In order to answer the research questions, the following objectives will be considered:

- To investigate technology adoption models in the literature.
- To propose a framework for the adoption of mobile learning at UoTs.
- To evaluate the proposed mobile learning adoption framework.

1.6. RELATED STUDIES

There have been similar studies done in this area. The current technological advances, such as mobile devices and wireless transmission, allow learners to access the learning management system (LMS) anytime and anywhere (Corlett et al. 2004), thus improving learner accessibility of information, mobility and learning activities (Han and Han, 2014). There is quick growth in m-learning, as technology constantly changes and educational institutions adjust to the changing demand of the digitally-oriented students, however, no evidence advocates that merely changing content from face-to-face classes and traditional LMS to mobile devices would be adequate (Lowenthal, 2010).

The diversity of student populations requires that institutions carefully consider all factors that influence the adoption of new technology prior to adoption. Several factors influence the adoption of innovative technologies (Han and Han, 2014, Lowenthal, 2010). A well-known model for innovation studies is the diffusion of innovations (Rogers, 2010) model. The model defines diffusion as a process by which innovation is communicated through certain channels over time among the members of a social system (Rogers, 2010). The model provides a pattern for understanding the adoption of innovations and acceptance or resistance to change (Petherbridge, 2007). A summary of the literature reviewed is represented in Table 1.1.

Table 1.1: Related studies summary

Author	Title	Model	Variables	Results	Evaluation Technique
Al-alak and Alnawas, (2011)	Measuring the acceptance and adoption of E-Learning by academic staff	Model derived from TAM and TRA (799 lecturers questionnaires)	Perceived usefulness, perceived ease of use (PEOU), normative pressure (NP), computer anxiety(CA), management support	The study focused on the attitude of users towards adoption of new technology. The findings show that there was a positive relationship between normative pressure and the adoption of new technology. However, the study did not show to what	Standard deviation, mean, frequency, percentage, correlation

				extent technology was adopted.	
(Martin et al. 2013)	A case study on the Adoption and use of Synchronous Virtual Classrooms	Theory of Diffusion of Innovations, Actor-network Theory (Herrington and Herrington), (52 Lecturers), online survey, Interview	Relative Advantage, Complexity	The study revealed that a combination of factors influences adoption of new technology.	Standard Deviation, Mean, Frequency, Percentage
(Samarawickrema and Stacey, 2007)	Adopting Web-Based Learning and Teaching: A case study in higher education	Actor-network Theory (Herrington and Herrington), Theory of Diffusion of Innovations (22 Lecturers) Interviews, Examination of artefacts, Field notes	Relative Advantage, Compatibility, Complexity, Trialability, Observability	The study showed that participants adopted web-based learning a response to top-down authority innovation directives; however, no adoption framework was proposed.	Frequency
(Han and Han, 2014)	Adoption of the Mobile Campus in a Cyber University	Theory of Diffusion of Innovations (85 Students Survey	Compatibility, Complexity, Relative Advantage, Trialability, Observability	This study focused on users' perception mobile learning. The study indicated that among factors examined compatibility and related advantage were positive factors that influence adoption.	Frequency Mean, Standard Deviation
(Lowenthal, 2010)	Using Mobile Learning: Determinates Impacting Behavioural Intention	Model derived from TAM (113 Students) Survey	Performance expectancy (PE), Effort expectancy (EE), Self-management of learning (Slife and Williams), Age, Gender, Behavioural Intention	The study focused on behavioural intention to adopt new technology. The findings indicated that there was a positive relationship between the determinate of effort and performance expectancy and the behavioural intent of the user	Correlation

2. RESEARCH METHODOLOGY AND DESIGN

Research is defined as a process where facts are discovered by means of investigation (Olivier, 2004). Whereas, research design refers to procedures and strategies for research that extend the choices from extensive assumptions to comprehensive methods of data collection and analysis (Creswell, 2009). This study followed a positivist research paradigm with a quantitative approach. A comprehensive literature study was carried out, to enable the researcher to gain profound understanding of the study domain. The mobile learning adoption model was then proposed.

The participants were recruited from a UoT in South Africa. The participants for the study consisted of both undergraduate and postgraduate Information and Communication Technology (ICT) students majoring in information systems. The students were invited to participate voluntarily in the study without credit reward or monetary compensation. A total of 68 students were included in the data analysis. A descriptive survey research was employed, with structured questionnaires to gather the necessary data. The study made use of a method of random sampling as this ensured a representative sample where each member of the population has an equal chance of being selected.

The Statistical Package for Social Sciences (SPSS) version 25.0 was used to carry out the statistical analysis. Descriptive statistics, correlation, Cronbach's alpha and composite factor analysis were used to evaluate data that were collected.

3. ETHICAL CONSIDERATIONS

The purpose of the study was clearly explained to all participants before the commencement of the study and anonymity was guaranteed. In addition, participants were assured that the information gathered would not be used against them and would not be used for anything other than for the purposes of the study.

4. LIMITATIONS OF THE STUDY

The study was subjected to the following limitations that can be improved in future studies:

- Responses were limited by the respondent's willingness to answer all questions honestly.
- The study is geographically limited to South Africa.
- The findings and their implications came from one UoT. The findings may, therefore, not be generalised across all UoTs.

5. OUTLINE OF THE DISSERTATION

This study consists of five chapters and a brief description is given below:

Chapter 1: Introduction and background: Starts with the introduction and background to the problem statement, followed by the context of the study, study location, research objectives and research questions.

Chapter 2: Literature review: Starts with a literature review on mobile learning followed by theories of m-learning adoption. This chapter also looked at what other researchers have previously argued in relation to this topic.

Chapter 3: Research methodology and design: Provides an overview of the methodology and design, which includes discussions on research philosophies, research strategies and data collection techniques, among others.

Chapter 4: Data analysis and results: Presents the data analysis used for the study.

Chapter 5: Recommendations and conclusion: Presents recommendations, evaluations and the conclusion of the study.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

The literature review considers previous studies by various researchers and it aims to assist the reader to become familiar with the South African Higher Education Institutions (HEIs), the students in HEIs and the SA higher education in general. The reader will also be familiar with basic terminologies and models used in the study, namely mobile learning and its characteristics. This chapter covers mobile learning, benefits and limitations of mobile learning, M-learning success factors, technology adoption models and the contrast of different adoption models.

2.2. HEIs IN SOUTH AFRICA

There are 26 public higher education institutions in South Africa distributed within all nine provinces, 11 traditional universities, 8 comprehensive universities and 6 universities of technology (UoT). Western Cape, Gauteng and KwaZulu Natal are home to the largest number of universities (USA, 2019). The 11 traditional universities are spread all over the country and were not affected by the merger that happened in 2004, which resulted in the formation of the current UoTs from what used to be technikons. Western Cape province is home to most of these traditional universities, namely the University of Cape Town (UCT) with seven campuses, the University of Western Cape (UWC) and University of Stellenbosch with three campuses. Gauteng province has the University of the Witwatersrand with four campuses and the University of Pretoria (UP) with six campuses. The Eastern Cape is home to Fort Hare University with three campuses and Rhodes University. The Free State province is host to the University of Free State with three campuses. North-West University has two campuses in the North-West province and an additional campus in Gauteng province. Limpopo province has Limpopo University with

a single campus in the province. Lastly, KwaZulu-Natal province has the University of KwaZulu-Natal (UKZN) with four campuses.

2.2.1. SOUTH AFRICAN EDUCATION CHALLENGES

Sadly, education in SA has faced many racially related challenges before the realisation of democracy (Jaffer et al. 2007). Thus, South African education, in general, is one of the areas that were negatively affected by the apartheid legacy. Prior to democracy, universities in South Africa were classified either as traditionally advantaged or traditionally disadvantaged. As a result, learners from certain racial and social groups did not always get the opportunity to obtain higher education qualification before the new democracy in 1994.

A study conducted by Calitz et al. (2006) revealed that students in the traditionally disadvantaged universities were predominantly African learners who were minimally exposed to modern technologies that support teaching and learning. Kruger and Ramdass (2011) point out that some of the biggest challenges under political pressure facing SA higher education is to ensure that all people in South Africa have equal access to higher learning in order to meet the new economic demands. The roots of such political pressures are found in the differences between the populations of South Africa, which researchers such as Harmelen and Pistorius (1997) have classified into world classes. The first-world class being a smaller, mostly skilled, predominantly white population and the third-world class, which comprises of a greater, mostly unskilled, predominantly black population. The recent census on the higher education landscape informs a significant increase for access to universities. Although South Africa has seen a drastic increase in access to education in recent years, previously underprepared learners continue to find difficulties when learning.

The birth of a democratic South Africa saw the restructuring of the education system. According to Harmelen and Pistorius (1997), a sudden accelerated national increase of 23% to 44% was realised immediately in the early days of the new democracy to

accommodate the black learners. Ntshoe (2003) notes that on political economy of access and equitable allocation of resources to higher education, the external influences of globalisation have denied people access to higher education to achieve social equity, social justice and social development.

2.2.2. UNDERSTANDING THE HEI STUDENTS IN SOUTH AFRICA

A university student is a learner who has successfully completed elementary schooling and, subsequently, been accepted into a higher education institution to be trained in a specific discipline. In their study, Hassim et al. (2013) highlight the importance for a first-year student to have a personal interaction with lecturers and fellow students. The broad and complex university environment, compared to the relatively uncomplicated high school environment, has proven to be one of the fundamental aspects affecting first-year students. This affects the adaptation of the first-year student to the university environment and in the process has an influence on the student's studies (Schoor, 2012)

The transition from high school life to university life is a complex process for nearly all first-year students (Sharma, 2012). Universities should have support systems in place to provide a smooth transition for the students at first-year level, provide assistance with the challenges they are likely to face and support them in their personal growth and development as they transform into adults in society (Sharma, 2012). Sharma (2012) also argues that the first-year students are affected by social change as much as they are affected by teaching and learning. The university community is different and much more versatile to high school; thus, first-year students find themselves having to not only adjust academically but also socially during their first year of study. "Developing countries face significant new challenges in the global environment, affecting not only the shape and mode of operation but also the purpose of their HEIs education system" (Salmi, 2012). Authorities in education must reflect on these words from the World Bank.

First-year students need to learn skills that will assist them to become emotionally stable adults equipped with skills to resolve conflicts with fellow students (Payton et al. 2008). These lifelong skills are important for students, as they will prove useful beyond student life. It is imperative for society and the education sector to rely on research-based findings

to ease first-year student's experiences at universities (Payton et al. 2008). The society needs to encourage first-year students to partake in structures that are put in place as supporting structures by the university.

2.3. MOBILE LEARNING

The progress of wireless technology and portable handheld devices has resulted in fundamental changes in the economic and social lifestyles of modern society. Many digital devices today are getting smaller in size, making them more portable than ever before. An increased number of users, including higher learning students, have become rather fond, comfortable and familiar with them as they continue to redefine their lives in various ways (Wang et al. 2009).

The use of information and communication technology (ICT), when coupled with learner-focused instruction, may greatly improve teaching and learning (Wang et al. 2009). Hence, various scholars came up with different definitions for mobile learning. The portability and the computational ability of mobile devices have impelled many scholars to focus their definition of mobile learning on the physical dimensions of the devices. Wang et al. (2009) describe mobile learning as the offering of learning material to students anywhere and anytime by means of wireless technology and mobile devices, including personal digital assistants (PDAs), smart mobile phones and digital audio players. Hashemia et al. (2011) concurs with Wang et al. (2009) by defining mobile learning as the utilisation of handheld technologies, along with wireless and mobile phone networks, to enhance, support, facilitate and extend the range of teaching and learning. Mobile learning's primary advantage is its mobility, allowing it to take place any time from any location including traditional teaching and learning environments such as classrooms, at home, workplaces and in community locations.

A different concept to define mobile learning is one that focuses on learner mobility, which is defined as the kind of learning that could be formal or informal, where learning happens virtually any time and anywhere by means of mobile devices (Bidin & Ziden, 2013). In this research, mobile learning is defined as the type of learning platform that offers

students the freedom and flexibility of learning anytime and anywhere by eliminating geographic restrictions and making collaborative learning possible between students and facilitators from different parts of the world. According to Yi et al. (2009) m-learning generally improves leaner performance by making learning accessible anywhere and anytime.

The traditional teaching and learning approach (face-to-face method) has recently being giving way to a more modern approach in the form of electronic learning (e-learning). With this in mind, some scholars have defined mobile learning as an e-learning extension that uses mobile devices to integrate with computing technologies, in order to offer learning material and support (Muyinda, 2007, Uğur et al. 2016, Hwang and Chang, 2011). Section 2.3.3 provides more details on e-learning.

M-learning has moved from the realm of researchers and specialists into the mainstream of society (Crescente and Leeb, 2011). With the acceptance of technology and mobile devices, educators are continuously changing the way they deliver content. Furthermore, the advance in wireless technologies and mobile devices, coupled with a variety of expectations and needs from various stakeholders, are among the driving forces that impelled many researchers to look into ways in which such technologies could be used for educational purposes (Bidin and Ziden, 2013, Wang et al. 2009, Uğur et al. 2016). Such advances encouraged higher learning institutions to improve their polices and strategies in teaching and learning continuously in an effort to remain relevant, competitive and effective.

The infiltration of ICT in the education system has encouraged both students and educators to become more and more computer literate. With the increased use of portable devices (tablets, PDAs, Smartphones, iPads etc.), mobile learning has over the years gained popularity as it is believed to be an effective and efficient tool for content presentation and knowledge acquisition in higher education (Bidin and Ziden, 2013). Students carry these devices anywhere for their daily activities. These wireless portable devices enable the students to get study material, assignments and assessments

anywhere and anytime. Students can thus take exams, share resources, download notes, upload assignments and these processes are then recorded and traced on the mobile learning systems, which enables the facilitator to keep track of students' processes and later report on them. They also facilitate 'on-the-go' learning, where students can take advantage of unanticipated spare time as they always have their devices with them.

The fundamental infrastructure to support mobile learning is said to be wireless technology, which main strengths include the ability to be used at anytime and anywhere, allows the education sector the opportunity to utilise it in numerous ways (Bidin and Ziden, 2013). The acceptance and availability of devices such as mobile music players, mobile smart phones and personal digital assistants, have radically changed the means and manner of socialising, communication and entertainment to the extent that is it nearly impossible to find any person in modern society who does not own at least one such device.

Mobile learning enables users to gain access to educational resources without necessarily being at their usual place of learning such as the classroom or working on a desktop computer. Such independence provides numerous benefits for m-learning environments, including but not limited to affording both students and instructors the opportunity to use their spare time, while travelling or waiting on queues, to work on their assignments, assessments or prepare for lessons. In addition to the independence m-learning offers, Jordaan et al. (2017) further point out that students are more inclined and eager to participate actively when learning with mobile learning; their desire to complete academic tasks also increases with the use of mobile technology and it helps them to become more proactive in their learning.

2.3.1. BASIC ELEMENTS OF MOBILE LEARNING

Basic mobile learning elements, as described by Ozdamlia and Cavus (2011), are learning environment, content, educator, student and assessment (Figure 2.1).

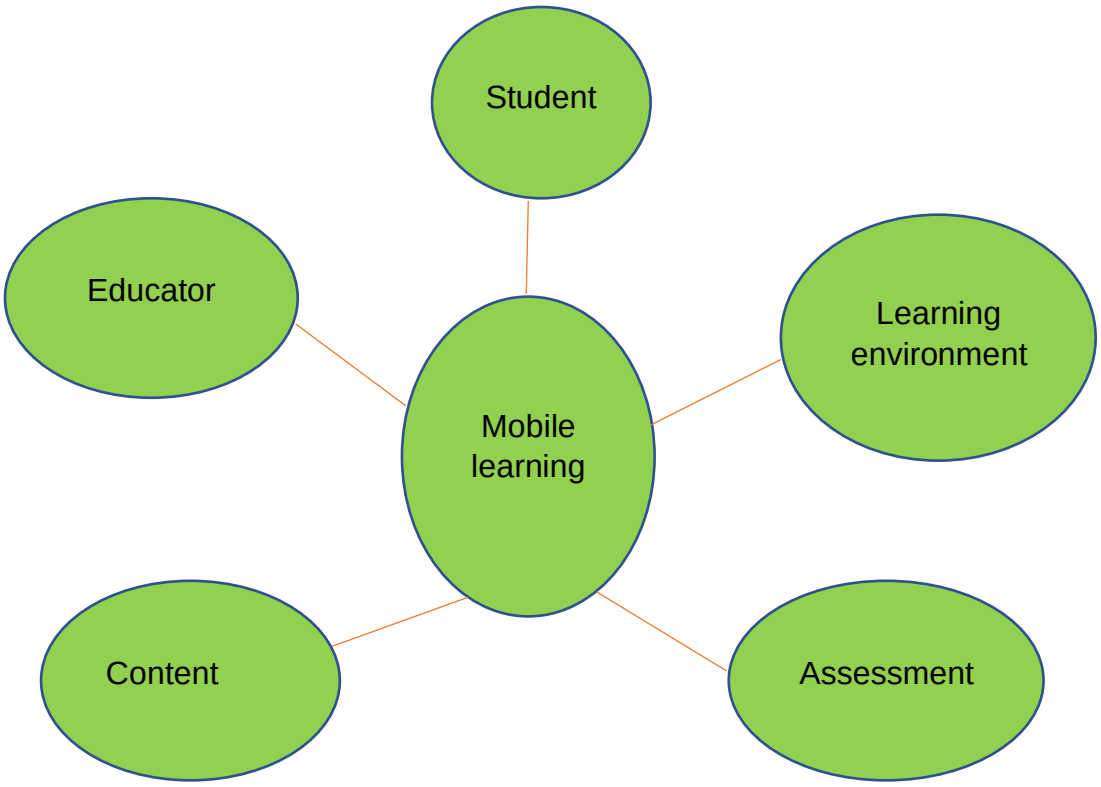

Figure 2.1: Basic m-learning elements Source: Ozdamlia and Cavus (2011)

Below is a brief description of what is entailed in each mobile learning element.

Learning environment

Learning environment refers to the type of learning space that allows the students to gain access to a wide range of information and resources and one that is available on mobile devices. The efficiency and effectiveness of learning environment on students relies significantly on its design (Siragusa et al. 2007). Additionally, Siragusa et al. (2007) and Uzunboylua et al. (2009) indicate that a properly designed learning environment offers the student a positive and exciting learning experience, thereby encouraging them to use it more often.

Content

Content refers to topics that students are expected to learn. According to Siragusa et al. (2007), the details and scope of the content offered to students may vary depending on the students' academic needs. It can then be concluded that in order for content to achieve the intended outcome, it should be decided, designed and compiled with the targeted audience in mind.

Educator

In a traditional learning environment, books and other media elements store information and educators convey the information to students (Ozdamlia and Cavus, 2011). However, the advance in wireless technologies and mobile devices, coupled with the recent shift in the education spectrum came with the shift in roles for educators. Ozdamlia and Cavus (2011) further note that this shift ranges from the platform where content is presented to the way it is presented including the type of student it is presented to. As a result, the role of educators also shifted. Instead of assuming the role of an expert, educators now take on the role of a consultant, which calls for more effort on their part as it requires them to identify each students' interests, link such interests to related topic learning outcomes and further provide the student with opportunities that facilitate the achievement of such outcomes.

Student

Modern learning approach caters to the digital students who are well accustomed to mobile devices and technology in general; it is fitting, therefore, that mobile learning is designed to be student-centred, building on the students' prior knowledge and skills, their needs, interests, expectations and their experience as indicated by Makoe (2010). Well-designed mobile learning allows the students to reason on their experience.

Assessment

Mobile learning systems are able to assess, record and report students' performance to the facilitator (Ozdamlia and Cavus, 2011). It is for this reason assessment is considered

an imperative component of mobile learning. According to Sharples et al. (2005), a good assessment is one that matches the capability of the students, thus providing an indication and formative guidance that builds on success.

2.3.2. FACTORS INFLUENCING MOBILE LEARNING

Various factors motivate both educators and students to utilise mobile learning applications. To effectively adopt mobile learning and successfully realise maximum benefits, considerable attention must be given to such influential factors. An in-depth review of the literature in which teaching and learning were delivered by means of mobile devices motivated the recommendation of these influential factors. They are classified into three main categories, namely user expectation, devices and pedagogical advantage.

User expectation

In a study conducted by Ligi and Raja (2017), it is indicated that students are more likely to attend to learning experiences if they are encouraged to assume a more active role in their own education. With the freedom and flexibility, it offers, m-learning allows the students to be at the centre of the learning process, thus playing an active role starting from determining their goal until the evaluation stage. Once they are actively involved with the task, they are more inclined to explore learning approaches that will support their learning development; hence, contribute to their motivation.

Features of devices

This factor is further subcategorised into three components, namely functionality, usability and privacy (Economides and Nikolaou 2008). ***Usability***: relates to how easy it is to learn, understand, remember and use the device and its tools (Economides and Nikolaou, 2008), the handheld device should be usable anywhere and anytime, making it easy to complete academic activities. ***Functionality***: functional features and tools in the device will enable the student to perform various academic activities. Ligi and Raja (2017) note that to continue getting maximum benefits of learning without time and location restrictions, functionality is an important factor that affects how students may be motivated

to use their mobile learning applications. ***Privacy****:* Mobile devices in comparison with other computing devices, offer the students a sense of privacy. Mobile learning applications offer the private virtual world to the learners that makes them feel safe, motivated and in control (Ligi and Raja, 2017). Having a sense of privacy positively influences the students to interact with mobile learning devices.

Pedagogical advantage

Pedagogical advantages of mobile learning include, but are not limited to, the following:

-Blended learning: Blended learning marries traditional physical classes with elements of virtual education, it occurs when some course meetings or exercises are conducted virtually rather than face-to-face. Shantakumari and Sajith (2014) define blended learning as "a way of meeting the challenges of tailoring learning and development to the needs of individuals by integrating the innovative and technological advances offered by online learning with the interaction and participation offered in the best of traditional learning". This branch of e-learning describes the enhancement of face-to-face interaction between educators and students with online learning opportunities, in the form of flexible, self-directed activities, which may use interactive, internet-based, multimedia, mobile or collaborative tools (Ana-Maria Bliuc, 2007). Students can work on their projects and assignments using mobile devices after a class session.

-Flexible learning: With high mobility of students comes the need for flexible learning. Flexible learning helps meet the needs of a wide range of students. It allows students to combine work and study, thus enabling students to develop the necessary skills to adapt successfully to change (Ligi and Raja, 2017). Mobile learning offers an opportunity for learning to take place without geographic restrictions. By providing choices in content delivery, personalisation of programs and scheduling options, flexible learning has proven to have a positive impact on the students' performance and increase access to education (Ligi and Raja, 2017).

-*Collaborative learning*: Collaborative learning is the most effective educational approach by which teaching and learning involves social interaction with peers, where groups of learners work together to solve a problem, complete a task, or create a product (Marjan Laal and Laal, 2012). This approach challenges students both socially and emotionally as it asks of them to listen to different perspectives and they are required to articulate and defend their ideas. Mobile learning devices make collaborative learning possible because of their accessibility.

-*Interactive learning*: students and teachers rely on each other to access sources of knowledge and share their information, increasing the general scope of the educational process to include not just instruction, but the expansion of knowledge (Li et al. 2018). The mobile devices function as the interactive agents that allow varying levels of interactivity and engagement with the technology (Ligi and Raja, 2017).

2.3.3. BENEFITS AND LIMITATIONS OF MOBILE LEARNING

This section discusses the benefits and limitations of mobile learning.

Benefits of mobile learning

Mobile learning offers many advantages that benefit both the students and instructors. Among such advantages are elimination of geographic boundaries, flexibility and mobility. Mobility allows teaching and learning to go beyond the traditional classroom; this provides a wide range of opportunities (Asabere, 2013). Learners also have control over the time and location. The concept of mobility is not restricted to students being mobile; it extends to the study materials and facilitators, as they are also not tied to a particular location (Moura and Carvalho, 2010). Crescente and Leeb (2011) indicate that other potential benefits of mobile learning include a significant decrease in training costs as it allows users to download/upload files and gain access to study material from anywhere if they have a good wireless connection and mobile learning offers an increase in productivity. Mobile learning is beneficial to academics as it provides alternative ways to teaching and learning for individuals who are open to doing things differently in the way in which they work and learn.

Mobile learning enables collaborations and interactions with people both within and beyond their geographic location; it builds both professional and personal support networks and it provides access to expertise over various knowledge areas readily available in an online learning environment (Sharples et al. 2005, Aubusson et al. 2009). While traditional learning offers collaborative learning scenarios as well, the use of mobile devices means that students can interact with fellow students and educators from different locations even when they are not in a formal classroom. Mobility, coupled with collaborative learning, makes the m-learning platform stand out from any other learning platforms (Alrasheedi and Capretz, 2015b). Crescente and Leeb (2011) further note that mobile learning capitalises on the ubiquitous nature of mobile technologies and their ease of use in a variety of locations. A study conducted by Asabere (2013) also identified the following mobile learning benefits:

- Mobile learning can occur at any time and it is not limited to a specific location.
- Mobile learning enhances interaction between students and facilitators.
- Mobile learning facilitates collaboration among students and facilitators through synchronous and asynchronous communication techniques.

Limitations of mobile learning

As with any technology, mobile learning is unfortunately not immune to challenges. One of the challenges when dealing with mobile learning is that some educational uses of mobile devices result in negative experiences for students who have to struggle with the tools being used (Heflin et al. 2017). One of the benefits of using mobile devices is that it allows users to access all kinds of information including social media sites; this may result in students being distracted by multitasking on mobile devices. In addition, Asabere (2013) notes that if there is no proper monitoring system in place, mobile learning may present opportunities for students to cheat.

2.3.4. CRITICAL SUCCESS FACTORS OF MOBILE LEARNING

The m-learning platform has changed the education spectrum and it has the potential to change the way content is presented. Many studies reviewing the adoption and success

of m-learning within universities focus on the technical capabilities of mobile devices (Alrasheedi and Capretz, 2015b). Mobile learning technology not only depends on mobile devices but on the interaction between machines and humans, putting the emphasis only on technicalities such as applications and devices limits the picture. The outlook of success factors must also be inclusive of the usage of m-learning in different contexts in addition to user experiences from the points of view of learners, educators and university management (Andrews et al. 2010)

Several researchers have conducted studies on m-learning to determine critical success factors (CSFs). Thus, various CSFs were identified as a result of the many case studies conducted. Cochrane and Bateman (2010) have been on the forefront of such studies, Naismith and Corlett (2006) conducted a study on mobile learning's critical success factors. Researchers agree that many other factors affect the success or failure of mobile learning, however, five factors appeared in all m-learning studies as ones with the most influence when it comes to the success of mobile learning. These factors are (i) network connectivity, (ii) technology availability, (iii) institutional support, (iv) curriculum integration and (v) technology ownership (Alrasheedi and Capretz, 2015a).

(i) Network connectivity

Internet connectivity is the most valuable use of mobile devices for both teaching and learning; it provides the ability to participate virtually in learning using mobile devices (Sharples et al. 2004). Being able to connect anytime and anywhere is more important than the connection speed. Successful mobile learning services make use of network connectivity whether wireless or through a fixed line. Naismith and Corlett (2006) highlight that lack of network connectivity can cause major disruptions to mobile learning systems.

(ii) Technology availability

Successful mobile learning services are significantly reliant on the availability of mobile technology. In a case where students did not own computers at home, the University of

Cape Town has successfully provided mobile learning services to students, taking advantage of the mobile devices owned by the students (Ng'ambi, 2005).

(iii) Institutional support

A good institutional support is paramount for mobile learning to succeed. While freedom and flexibility are key benefits of mobile learning, it has been noted that extensive and well thought out support resources that include a good software and equipment maintenance routine and staff training are essential to the success of mobile learning (Naismith and Corlett, 2006).

(iv) Curriculum integration

Successful mobile learning systems do not operate in isolation; they are imbedded into the curriculum. Incorporating mobile learning into the curriculum increases participation of the academic staff who may not be naturally inclined to use the m-learning at first. However, a clear connection between what they are expected to teach and the materials and tools they use for teaching must be defined (Naismith and Corlett, 2006). Naismith and Corlett (2006) also note that to archive maximum intergartion with the students experience, starting with a familiar technology and incoporating mobile devices to make it more interactive is paramount.

(v) Technology ownership

Students feel more motivated to learn when they either own the technology or treat it as their own and are free to upgrade or customise it however way they wish (Bidin and Ziden, 2013).

2.3.5. E-LEARNING

Many researchers have provided various definitions for the term e-learning. Among such researchers is Akkoyunlu and Soylu (2008) who define e-learning as a learning environment where instructional materials are transferred electronically through the Internet and web technology with the help of computer technologies in teaching and

learning where the teacher and the learner are in different physical environments. Baskaran et al. (2017) and Alsaiari et al. (2014) also refer to e-learning as a kind of learning, which occurs by means of electronic technology through the Internet. The most significant characteristics of e-learning, as noted by Akkoyunlu and Soylu (2008), are that the teacher and the learner are in different physical environments and that the communication throughout the teaching/learning process is carried out via e-mail, forums etcetera through the Internet.

Higher learning institutions have recently shown an outstanding interest to offer e-learning courses due to the significant potential of e-learning to deliver services in both the synchronous and asynchronous form to a large number of learners who are directed towards life-long learning (Adetoba et al. 2016). E-learning plays a significant role in replacing the traditional (face-to-face in a physical class) approach of teaching and learning (Dai et al. 2016). Not only does e-learning significantly reduce the initial cost for deployment, making it easy to manage both users and resources, it also enhances teaching and learning in many ways. Additionally, Dai et al. (2016) note that e-learning is a convenient and cost-effective means to gain access to information and acquire knowledge while pursuing higher education.

E-learning systems can be characterised into two categories, namely learning management systems (LMS) and the course management systems (CMS) where CMS refers to a set of tools that allows the facilitator to create comprehensive online course material and post it on the Web without having to use any programming languages (Nyeko and Ogenmungu, 2017a). CMS can further be categorised into two components, (i) the administrative components, which involve class schedules and student grade records and (ii) the teaching component, which comprises of all aspects of teaching, learning objects, class exercises, student-teacher interaction, tools for real-time chats, quizzes, or asynchronous bulletin board type communications and tests (Nyeko and Ogenmungu, 2017a). LMS on the other hand are software programs for tracking, reporting, documentation, the administration and delivery of e-learning courses or training programs that encompass all aspects of the learning process. Nyeko and Ogenmungu (2017a)

further suggest that LMSs are platforms that manage and distribute instructional content, identify individual and organisational learning outcomes and handle assessments as well as automating, record keeping and supporting employee registration.

2.3.5.1. E-LEARNING BENEFITS

There are many learning styles and teaching and learning processes should not take a 'one-size-fits all' approach. E-learning takes into account that students are different and that they learn in different ways, hence it offers the platform for various types of information such as text, sound, videos and pictures that are stored for as long as it is required and are accessible from anywhere (Nyeko and Ogenmungu, 2017a). With e-learning systems, the students can use their mobile devices to download online study materials, read, take exams and upload their assignments quickly. In addition to quick and easy access to learning materials, students can save time and money spent on travelling and getting the printed materials for their studies. They can reduce printing costs by reading the available learning materials online (Dai *et al.* 2016). E-learning eliminates geographic boundaries and offers flexibility, making it possible for everyone to learn regardless of their physical location and it promotes life-long learning.

2.3.5.2. E-LEARNING CHALLENGES

Although e-learning offers many benefits to its users, it faces several concerning challenges, especially issues of security. Dai et al. (2016) identified the following threats and security concerns that affect e-learning systems: hackers and malicious attacks. Hackers use malicious codes to corrupt, destroy or steal information from their victims' computers; malicious attacks are programs that monitor user's online activities with the intention of capturing their personal information.

Nyeko and Ogenmungu (2017a) further identified additional security concerns for the e-learning system including authentication, availability, integrity and confidentiality. ***Authentication*****:** the attackers steal user's credentials and try to access the system pretending to be authorised users. ***Availability***: availability in e-learning refers to the

assurance that the e-learning environment is accessible by authorised users, whenever it is needed (Adetoba et al. 2016). The challenge comes when the intruders use DoS or DDoS technology to attack the victims. ***Integrity****:* unauthorised users alter the content of the information by executing malicious codes. ***Confidentiality****:* insecure storage, information leakage (Dai et al. 2016). These challenges can be counteracted by a strong updated infrastructure including fast Internet connection, modern technology, regular maintenance, continuous power supply, security and effective administration.

2.6. UNDERPINNING THEORIES OF TECHNOLOGY ADOPTION

For a research study to have value and contribute, it must be underpinned by theory. According to Gregor (2006), theories in research studies are useful in assisting researchers with the explanation, analysis and prediction of a phenomenon. Simply put, while an empirical analysis may provide correlated phenomena, theory expresses why such correlation exists (Lim et al. 2013).

Mobile computing has, over the years, extended from being mainly technical to now also being about usefulness, usability and user experience. Adoption, as defined by Sharma and Mishra (2016), refers to “the stage in which a technology is selected for use by an individual or an organization”. In the 1980s, Fred Davis conducted a study on user adoption of information technology, two important constructs, perceived ease of use and perceived usefulness in the technology acceptance model (TAM), have since had a lasting impact on both the education and management literature (Hsiao et al. 2016). Many scholars have made efforts to determine behavioural factors that influence individuals to adopt and eventually use a particular technology. Models and theories have been developed in various disciplines and are used in explaining, understanding and predicting users’ acceptance and adoption of new information system products or technologies (Tarhini et al. 2016)

Each scholar using a framework to study the adoption has identified factors to measure user’s behaviour and their intention to use new technology. Perceived usefulness, perceived ease of use, attitude and intention to adopt are some of the factors, which will

be discussed in more detail in this section. The extensive research in the information system field has resulted in numerous theoretical models that have evolved over the years for explaining adoption of technology and are summarised below.

2.6.1. TECHNOLOGY ACCEPTANCE MODEL (TAM)

TAM is a technology acceptance model originally introduced by Davis (1989) to explain computer-usage behaviour. Since its introduction, TAM is commonly alluded to and a significant model for understanding the acceptance of information technology in many acceptance studies and it has received extensive support (Byoung-Chan Lee, 2009). TAM was derived from Fishbein and Ajzen's (1975) theory of reasoned action (TRA). The main purpose of TAM is to offer a basis for tracing the influence of external variables on internal beliefs, intentions and attitudes. It proposes that perceived usefulness and perceived ease of use are the two most significant features in explaining system use. Studies suggest that perceived ease of use refers to the degree to which a person believes that using a certain system would be free of effort, while perceived usefulness refers to the degree to which a person believes that using a certain system would enhance his or her job performance (Davis, 1989, Byoung-Chan Lee, 2009, Ana-Maria Bliuc, 2007, Tshabalala et al. 2014). These two beliefs both influence users' attitude toward using information systems (IS). Despite the potential of m-learning as a tool to enhance education and training performance, its value will not be realised if users do not adopt it as a learning tool. Since m-learning utilises information technology, TAM has been extensively utilised and extended for research in an e-learning and m-learning context (B-C. Lee et al. 2009).

Hsiao et al. (2016) argue that this theoretical model hypothesised that the actual use of a certain technology is directly influenced by a person's behavioural intention to use, which in turn, is determined by perceived usefulness (PU) and attitude toward the technology. Additionally, users' perceived ease of use (PEOU), another key determinant of TAM, is modelled as the antecedent factor of the PU and attitude. A study conducted by Rawashdeh (2015) revealed that perceived usefulness, perceived ease of use and perceived web privacy have a direct and indirect influence on behavioural intention,

whereas perceived ease of use and perceived web privacy affect perceived usefulness and behavioural intention towards using Internet banking (Figure 2.2).

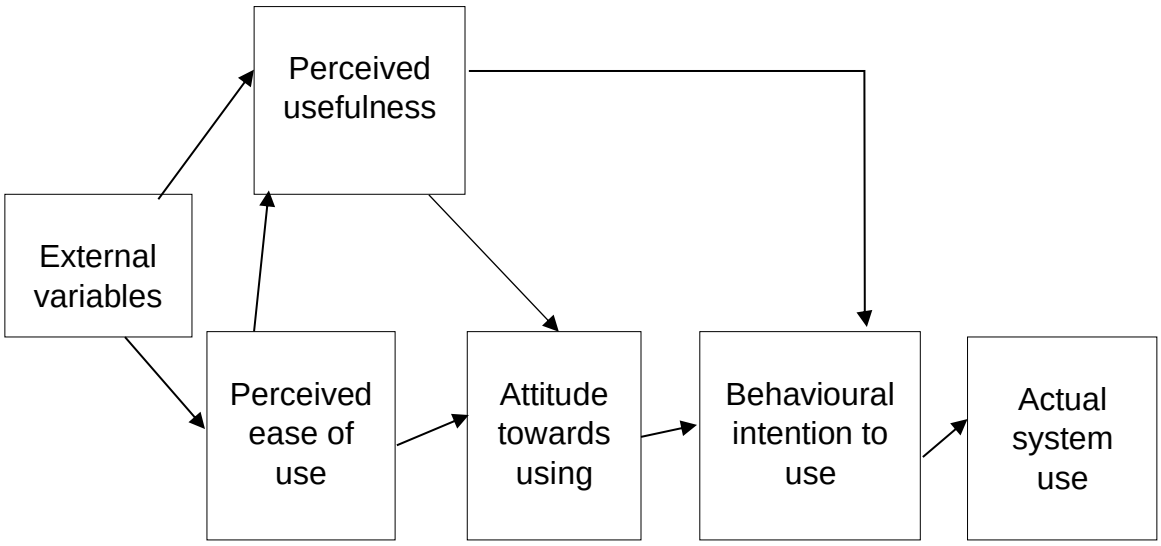

Figure 2.2: Technology Acceptance Model (TAM) Source: Davis (1989)

2.6.2 TECHNOLOGY ACCEPTANCE MODEL 2 (TAM2)

TAM 2 is the extension of TAM developed by Davis and Venkatesh (2000). TAM2 uses TAM as its basis; it is extended by incorporating additional determinants determining perceived ease of use and perceived usefulness in terms of cognitive and social processes. The three social processes determinants include image, subjective norm and voluntariness. The four cognitive process determinants include output quality, job relevance, perceived ease of use and result demonstrability. Osubor and Chiemeke (2015) note that TAM2 reflects the impact of voluntariness, subjective norm and image. The relationship among these three constructs is an important determining factor that affects user acceptance or rejection of a new technology. TAM 2 as shown in Figure 2.3 suggests that subjective norm is the medium of social influence processes; therefore, it is defined as the user's perception that most people/individuals valuable and influential to him/her think he should or should not engage in the behaviour in question.

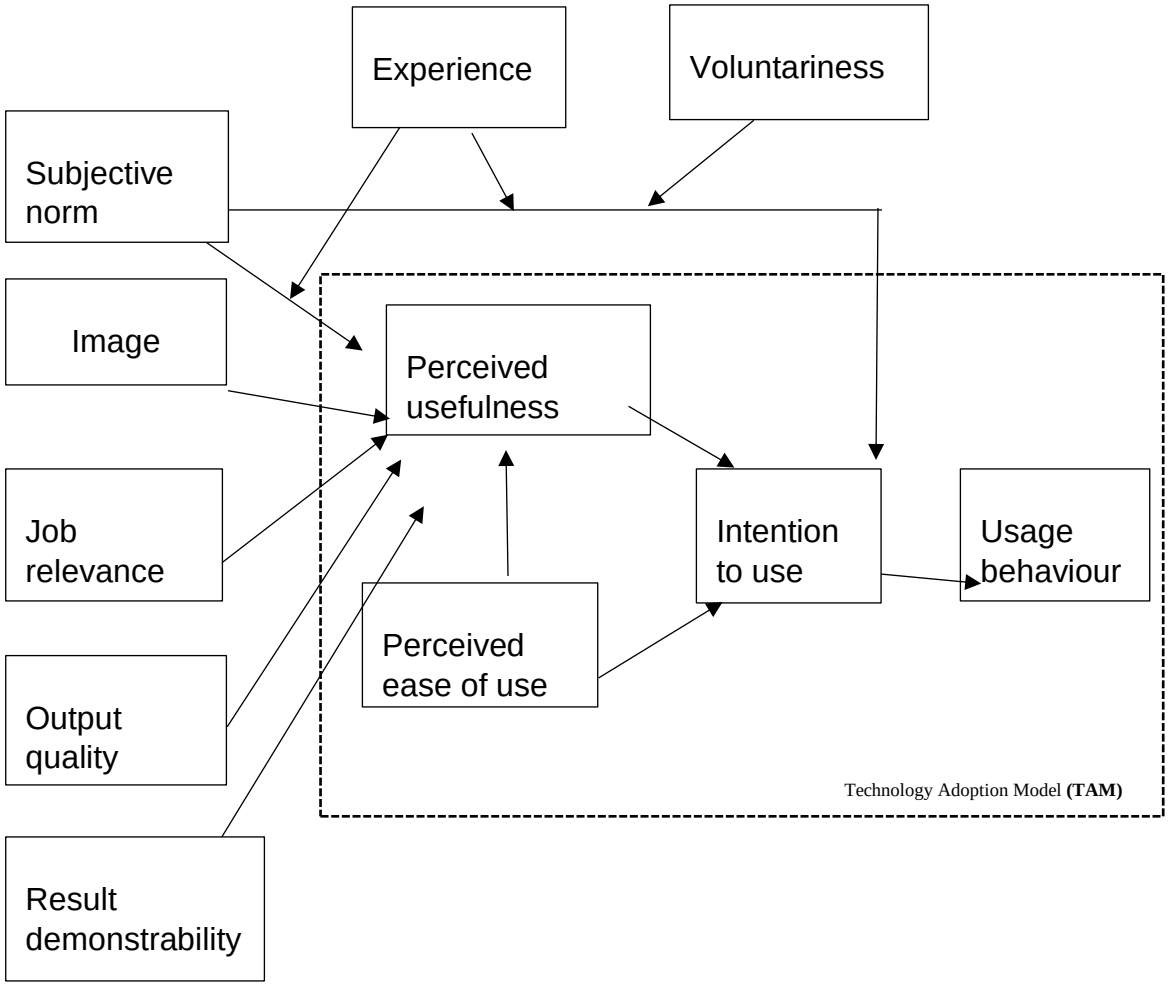

Figure 2.3: Technology Acceptance Model 2 (Source: Venkatesh & Davis, 2000)

2.6.3. TECHNOLOGY ACCEPTANCE MODEL 3 (TAM3)

Another extension of TAM is TAM 3; according to the TAM3 model, the perceived ease of use is determined by computer self-efficacy, computer playfulness, computer anxiety and perception of external control, perceived enjoyment and objective usability (Jeffrey, 2015). The perceived usefulness on the other hand is determined by subjective norms, job relevance, result demonstrability and image (Ahlan and Ahmad, 2015). However, TAM 3 has faced much criticism, one being that it has too many variables and too many relationships between the variables. Ming-Chih et al. (2016) indicate that in the TAM3 research model, the perceived ease of use to behavioural intention was moderated by

experiences. The TAM3 research model was tested in real world settings of IT implementations. See Fig. 2.4 for TAM3.

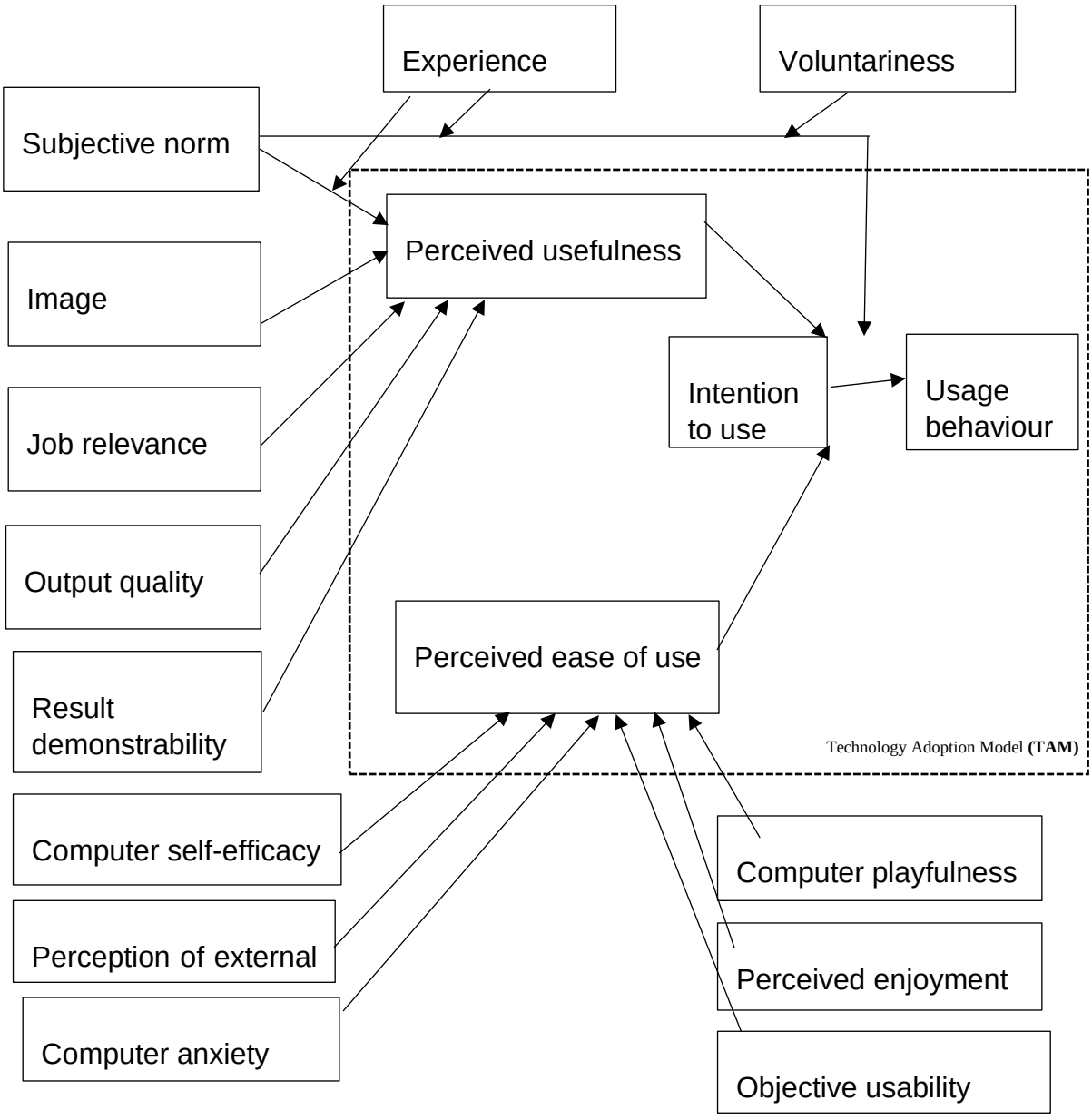

Figure 2.4: Technology Acceptance Model 3 Source: Venkatesh and Bala (2008)

2.6.4. EXTENDED OF TAM (TAM)

Extended of TAM proposed by Park and Kim (2014) suggests that perceived usefulness and service and system quality are determined by perceived mobility. Perceived mobility

refers to the extent to which system users are aware of the mobility value of mobile systems and services (Figure 2.5).

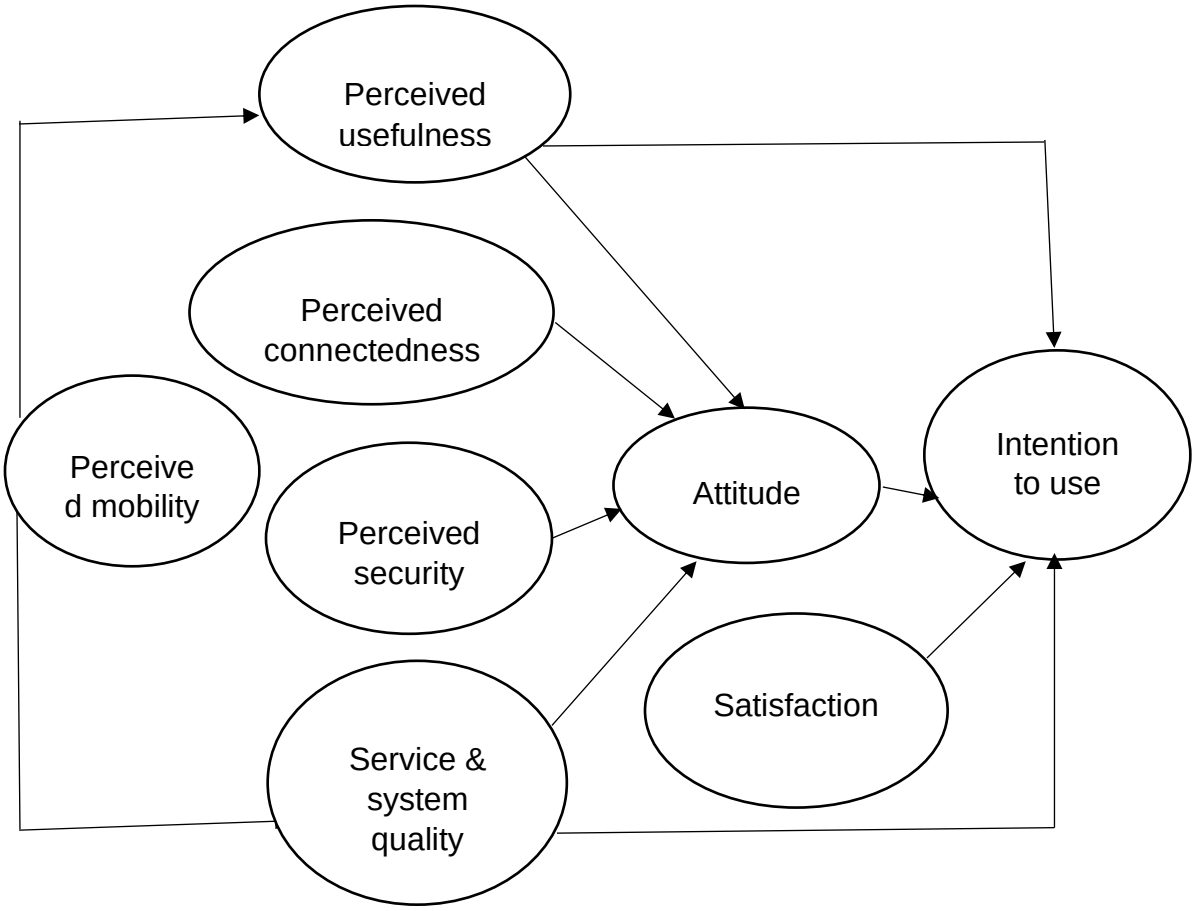

Figure 2.5: ETAM (Park and Kim, 2014)

2.6.5. THEORY OF REASONED ACTION (TRA)

The TRA is a comprehensively studied model from social psychology, which is concerned with the determinants of consciously intended behaviours. According to the TRA, a person's performance of a specified behaviour is determined by his or her behavioural intention (BI) to perform the behaviour and behavioural intention is jointly determined by the person's attitude (A) and subjective norm (SN) concerning the behaviour in question (Fishbein & Ajzen 1975). TRA was originally proposed by Fishbein and Ajzen in 1975 to understand behaviour and predict outcomes.

The foremost assumption of TRA is that a person considers the implications of his/her action before he/she resolves to participate or not participate in certain behaviour. It also posits that the main determinant of a person's behaviour is behaviour intent. Fishbein and Ajzen (1975) further point out that a person's attitude is influenced by his/her perception about the expected outcomes of performing the behaviour and the assessment of those outcomes, hence, if a person's intent is strong, then it is likely that the behaviour will in fact be performed (Basheer A. Al-alak, 2011).

According to Akhavan et al. (2015) the power of a person’s intention in behaviour hails from two factors: subjective norms that are driven by social influence and the attitude toward behaviour. These factors are primarily affected by beliefs, where belief about the consequence of specific behaviour and the evaluation of the consequence then shapes the attitude. Subjective norms are also influenced by beliefs. Attitude, according to a description given by Nadlifatin et al. (2016), refers to the person’s evaluation of the behaviour or action intended whereas subjective norms are perceived expectations of the person’s significant others with respect to the behaviour intended.

Researchers have successfully used TRA to understand and predict human behaviour in a variety of situations. The subjective norm is the second variable weighted for behaviour intention. Myresten and Setterhall (2015) describe subjective norm as a person's perception that most people influential to him/her think he/she should or should not engage in a behaviour in question. Subjective norm has three functions: perceived expectations from society, the actual motivation to act on such expectations and perform the behaviour and the number of reference group beliefs (Fishbein and Ajzen, 1975). See Figure 2.6 for TRA.

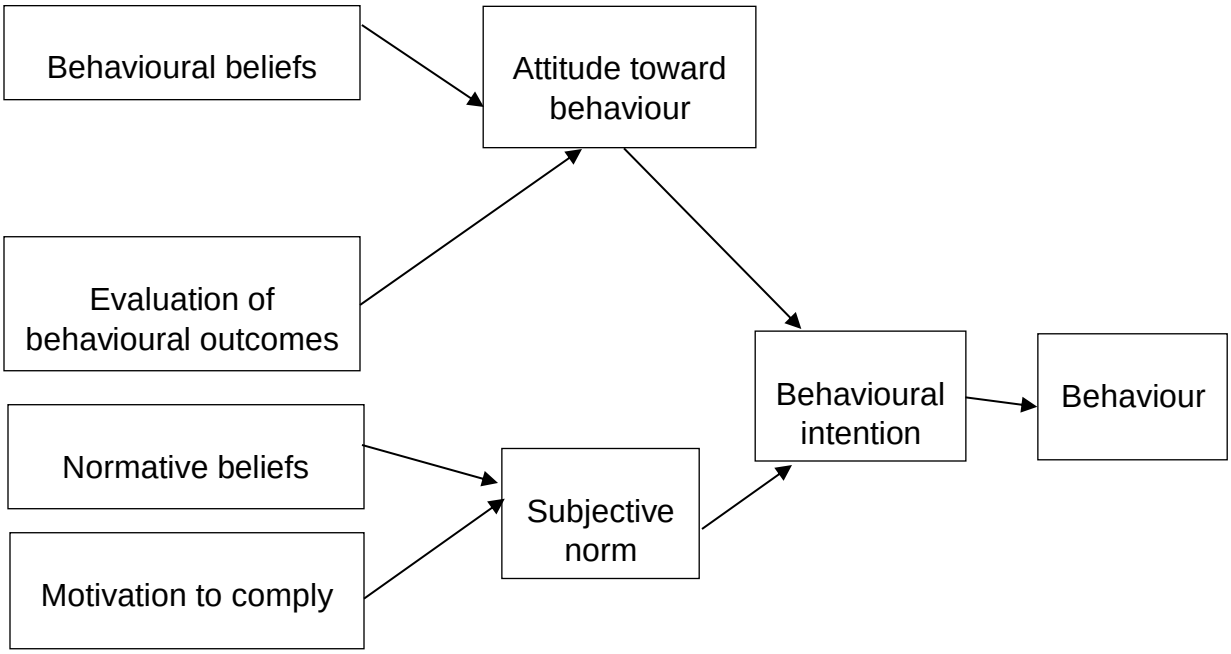

Figure 2.6: Theory of reasoned action (Source: Fishbein & Ajzen 1975)

2.6.6. UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

After careful consideration of the existing literature, Venkatesh *et al.* (2003) developed the unified theory of acceptance and use of technology (UTAUT) as an all-inclusive combination of prior technology acceptance research. UTAUT comprises of four significant paradigms, namely effort expectancy, social influence, performance expectancy and facilitating conditions. According to UTAUT, effort expectancy, social influence and performance expectancy are said to influence behavioural intention to use the technology, while behavioural intention and permitting conditions determine the actual technology use. In addition, individual variables, such as gender, age, voluntariness and experience moderate key relationships in the model Venkatesh et al. (2012). The model further proposes that effort expectancy coupled with performance expectancy and social influence have an influence on behavioural intention to use a technology, while behavioural intention and facilitating conditions determine the actual technology use (Yaser et al. 2016).

Various researchers have provided a brief description of each of the constructs of the UTAUT model. Raeisi and Behboudi (2016) define **performance expectancy** as the

degree to which an individual believes that the use of a particular system will help him/her improve his/her job performance. It is considered the most influential predictor of user intention. The construct is moderated by gender and age and portrays that men, especially younger men, tend to have a more intense effect. Kolog et al. (2015) on the other hand defines **effort expectancy** as the level of simplicity associated with the use of a particular system, whereas **social influence** speaks to the degree to which an individual perceives that other individuals important to him/her believe he or she could use the particular system (Abrahao et al. 2016). Lastly, **facilitation condition** refers to the degree to which an individual believes that an organisational and technical infrastructure exists to support the use a new technology (Venkatesh et al. 2003). The construct proposes that an individual is influenced by the way he/she thinks others will perceive him/her having used the particular technology.

In relation to education and academic staff, Oye et al. (2014) expressed the relevance of UTAUT in anticipation of acceptance and use of information and communication technologies by the staff of University of Nigeria (ADSU – Adamawa State University). The case study revealed the intention to use technologies that are easy to use and improve professional performance. The findings further highlighted the social influence and expectation of effort as the primary predictors and put time and technical support as the fundamental obstacles to the acceptance and use of technology. In another study, Martins et al. (2014) proposed a conceptual model that combines the UTAUT with the perceived risk to explain behavioral intention and Internet banking use behavior. The research was conducted with students and former students of a Portuguese university and concluded that the importance of the performance expectation, effort expectation, social influence and risk factors in the prediction of intention is key. See Figure 2.7 for the UTAUT.

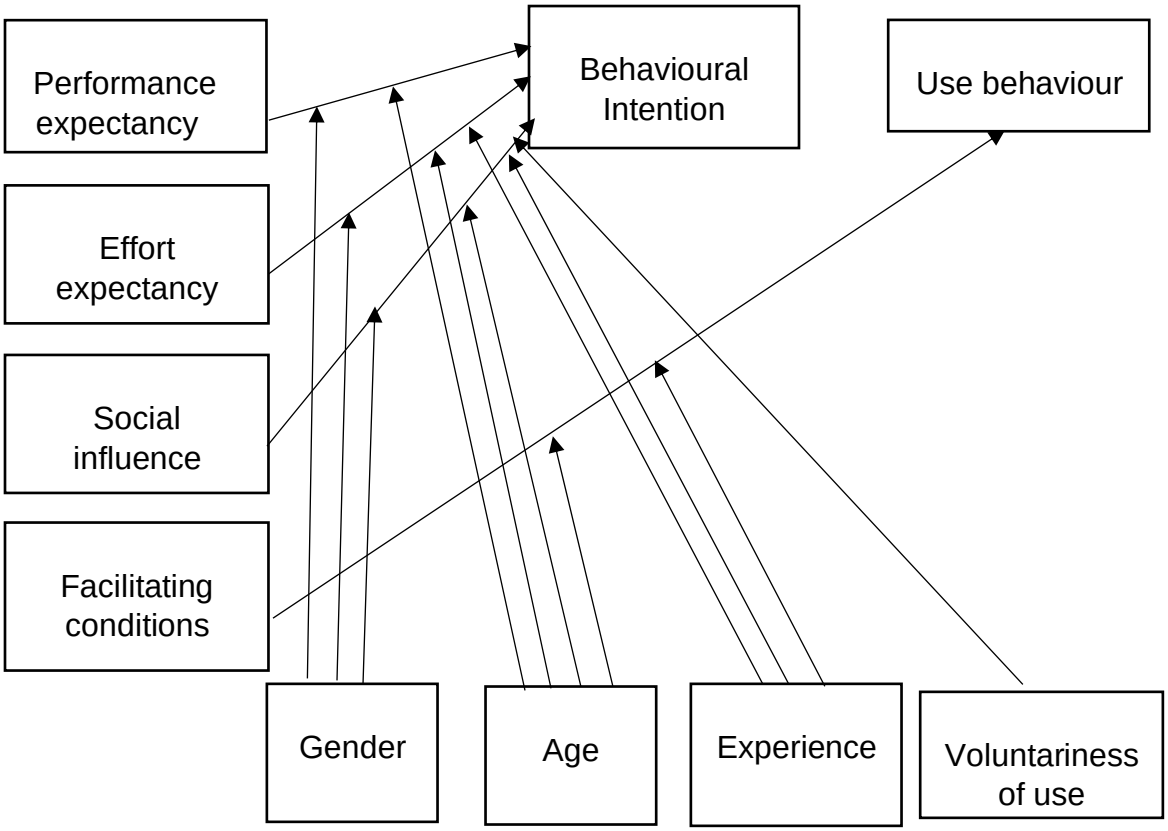

Figure 2.7: Unified theory of acceptance and use of technology (Source: Venkatesh *et al.* 2003)

2.6.7. DIFFUSION OF INNOVATION THEORY (DOI)

DOI is a theory concerned with why, how and at what rate new ideas and technology spread through cultures, operating at the individual and firm level. Diffusion is portrayed in the diffusion of innovation theory as the process by which an innovation is communicated over time to members of society through certain channels (Rogers, 1983). It is a special type of communication in which the messages mainly focus on new ideas. Rogers (1983) went on to define communication as a process in which participants create and share information amongst each other in order to reach a mutual understanding. Rogers (1983) further reasoned that communication is a two-way process rather than a linear act in which one person transfers information.

Individuals possess different levels of willingness to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is normally distributed over time (Oliveira and Martins, 2011). The innovation process in organisations is, however, a much more complex process. It is dependent on several individuals, including those who are for and against the new idea, each of whom plays a role in the innovation decision. The four primary elements in DOI, as identifiable in various diffusion research studies, are the innovation, communication channels, time and the social system. ***Innovation*** is an idea or a practice that is seen as new by an individual or other unit of adoption, whereas ***communication channel*** is the means by which messages are distributed from one individual to another, ***social system*** refers to a set of interrelated units that work together in solving various problems to accomplish a common goal (Rogers, 1983). Characteristics of innovation help to explain different adoption levels. Rogers as cited by Mirjam (2015) suggests that the characteristics of innovation motivate adoption of innovation at different levels. These characteristics, described by Rogers, are the following:

(a) Relative advantage

Relative advantage is the extent by which a group of users perceive innovation as better than the idea, or practice it replaces (Rogers, 1995, Legg and Mitchell., 2016). The bigger the perceived relative advantage of innovation by the organisation, the faster the level of adoption will be (Rogers, 1995). Depending on the perceptions of individuals and the need of the organisation, the relative advantage can be either financial or non-financial. The level of advantage can be measured in social prestige, pleasure or financial terms.

(b) Compatibility

Compatibility refers to the degree to which innovation is perceived as consistent with existing values, attitudes, experiences and needs of potential innovation adopters (Yunus, 2014). An innovation that is incompatible with the values and norms of their practices will not be adapted as fast as compatible innovation will be (Rogers, 1995).

(c) Complexity

Complexity is the degree to which innovation is perceived as difficult to understand and use. The easier innovation is to understand, the faster it will be adopted. Innovations that are complex to understand and use generally require adopters to develop new skills (Mirjam, 2015).

(d) Observability

Rogers (1995) and Mirjam (2015) agree that observability speaks to the level at which the results of innovation are noticeable to adopters. The more visible the relative advantages are to users the more inclined they will be to adopt the innovation.

(e) Trialability

Trialability is the degree to which the innovation may be tested on a trial basis. Innovations are easier to adopt if they can be tried out in part, on a temporary basis, or easily dispensed with after trial (Degerli et al. 2015). See Figure 2.8 for a graphical representation of DIO.

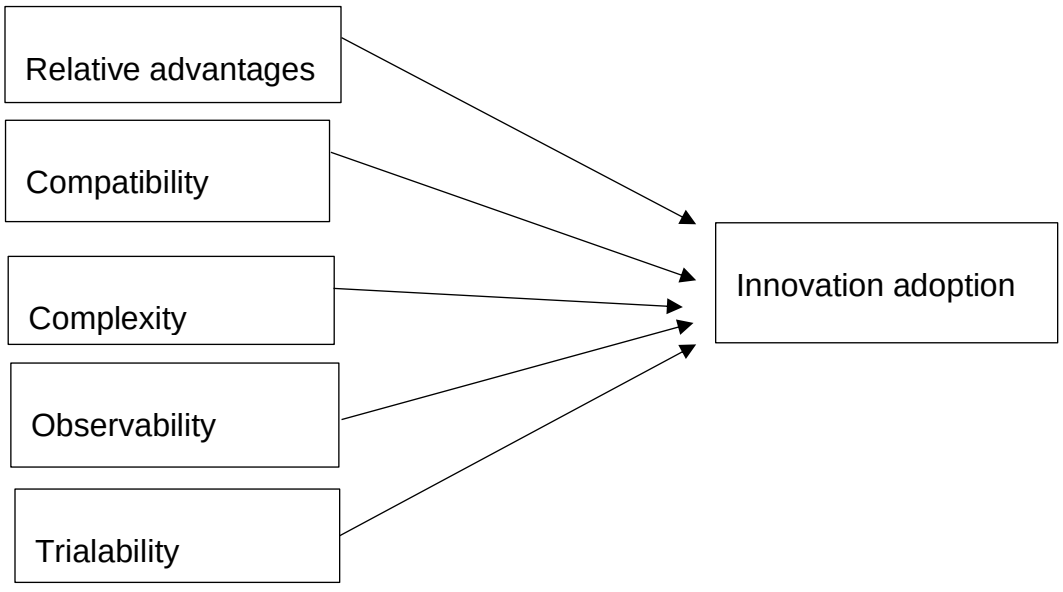

Figure 2.8: Diffusion of innovation (Source: Rogers, 2003)

2.6.8. THEORY OF PLANNED BEHAVIOUR (TPB)

TPB studies the relationship between the intention and the actual behaviour with the understanding that a person's behaviour is greatly influenced by the person's activities plan. Ahmad et al. (2014) suggests that there are three major determining factors of intention, namely subjective norms, attitude towards the behaviour and the perceived behavioural control. TPB was proposed by Ajzen in 1985 and subsequently used in many studies related to behaviour. TPB has been widely used in the prediction of behaviour; it states that intention is an indication of a person's willingness and readiness to perform a certain behaviour and is considered the immediate originator of behaviour. Generally, the stronger the intention to perform a behaviour, the more likely its performance should be. See Figure 2.9 for theory of planned behaviour constructs.

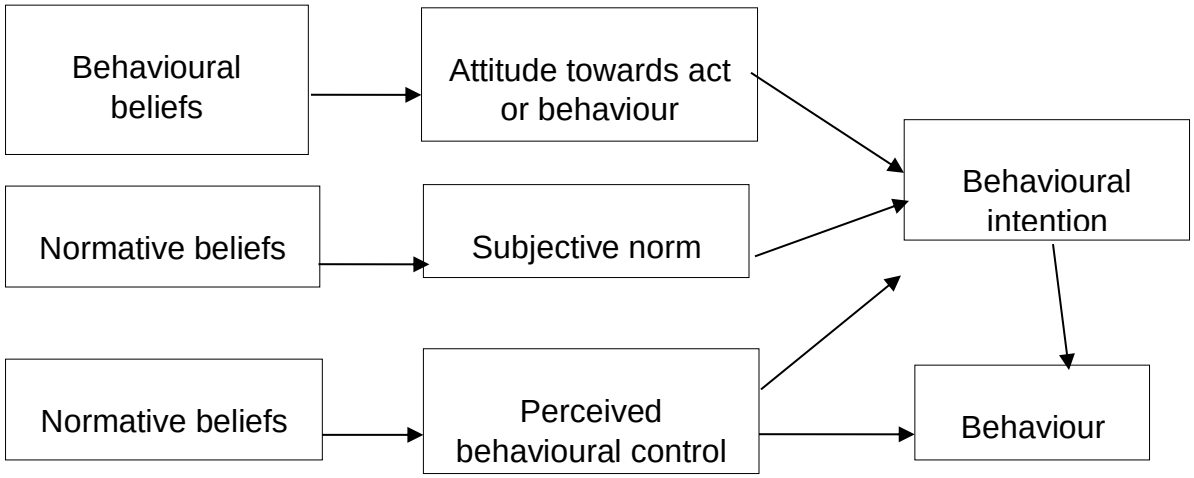

Figure 2.9: Theory of planned behaviour (Source: Ajzen, 1985)

2.7. CONCLUSION

This chapter discussed background, benefits and challenges associated with mobile learning, elements that influence mobile learning and critical success factors of mobile learning. The chapter also touched of HEIs in SA and some of the challenges facing SA education. Technology adoption models were also discussed in detail to pave the way for the formulation of the proposed research framework in the next chapter.

CHAPTER 3

RESEARCH METHODOLOGY AND DESIGN

3.1. INTRODUCTION

This chapter discusses the research philosophy, approach and strategy, which form the fundamental basis for selecting an appropriate research design and methodology to explore the adoption of mobile learning as an effective supporting tool for teaching and learning. The chapter further discusses the data collection method as well as the sampling techniques used to select the participants. The methods used to analyse and present the results are also discussed.

3.2. THE CONCEPT OF RESEARCH

Different researchers and scholars working in different fields have proposed several definitions of the term research. These definitions range from simple to complex and differ from scholar to scholar. Singh (2006) defines the term research as consisting of two words: re + search. Re' means again and again and 'search' means to find out something.

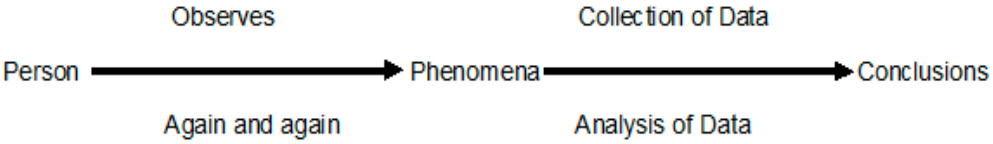

Figure 3.1: Process of research (Source: Singh, 2006)

The Oxford Advanced Learners 'Dictionary of Current English (1986:720) defines research as "systematic investigation undertaken in order to discover new facts, get additional information". Whereas Saunders et al. (2003) define it as "something that

people undertake in order to find out new things in a systematic way, thereby increasing their knowledge”

From the definitions of research given above, it can be concluded that research is a planned action, intended to establish new evidence and information about a specific phenomenon. The process of research encompasses the identification of an area of interest or a problem, translating that into a research problem, collecting data, studying and analysing the collected data and then reporting the results of the research.

3.3. RESEARCH DESIGN

Like the term research, research design is defined differently by different researchers and authors. According to Creswell (2009), research design refers to procedures and strategies for research that extend the choices from extensive assumptions to comprehensive methods of data collection and analysis.

McMillan and Schumacher (2001) define it as a plan for selecting topics, research positions and data collection procedures to answer the research question(s). It can be said that research design is a practical plan in which specific research procedures and methods are combined together to obtain a valid and reliable body of data for analyses, conclusions and theory formulation; research design thus offers the researcher a clear research outline, it guides the methods, decisions and sets the foundation for interpretation. It serves as a bridge between research questions and the execution, or implementation of the research strategy. The main objective of a sound research design is to deliver results that are deemed credible. Illustrated in Figure 3.1 are layers of research design as described by Saunders et al. (2009).

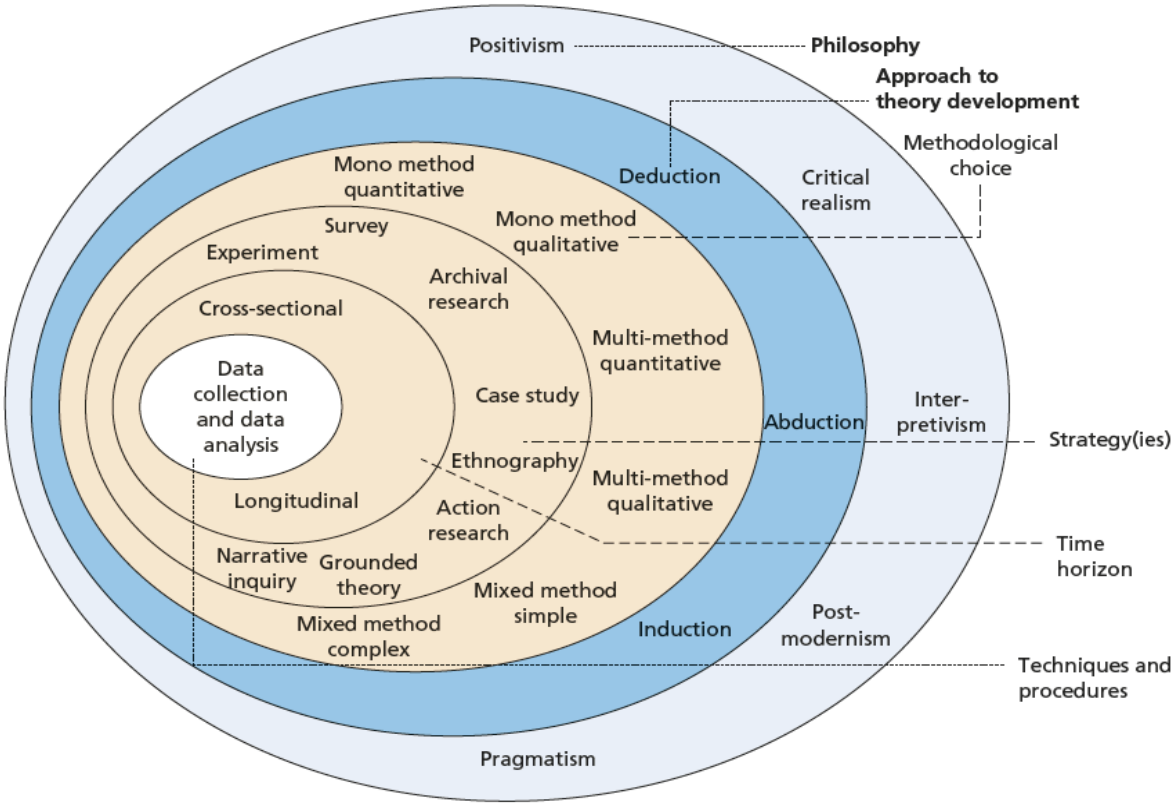

Figure 3.2: Research Onion (Source: Saunders et al. 2016)

The research onion offers a summary of the vital factors that need to be taken into account and studied before embarking on any research project. The different layers of the onion serve as a foundation to consider the following: the research approach adopted the philosophical orientation of the researcher; the research timelines that are under review, the appropriate research strategies and the data collection techniques used by the researcher.

In order to reach sound conclusions for this study, an empirical study involving a quantitative data collection exercise was adopted to gain an understanding into the experiences of the participants regarding the adoption of mobile learning.

3.3.1. RESEARCH PHILOSOPHY

Research philosophy refers to a system of beliefs about the way in which data about a phenomenon should be collected, studied and used (Saunders et al. 2009). Therefore, research is supported by the philosophical assumptions, which show a certain way in which the world is perceived (Saunders et al. 2009). When conducting research, whether the study should be philosophically informed is not of much importance, but how well the study is able to reflect upon the philosophical choices made and defend them in relation to the alternatives they could have adopted (Johnson and Clark, 2006).

It is vital, therefore, that the two utmost important factors that form the basis of research philosophy, epistemology and ontology are well examined and understood, in order to ensure that a suitable method to conduct the research is adopted. A framework for research philosophy, 'the interconnection of worldviews, design and research methods', as described by Slife and Williams (1995), is illustrated in Figure 3.2.

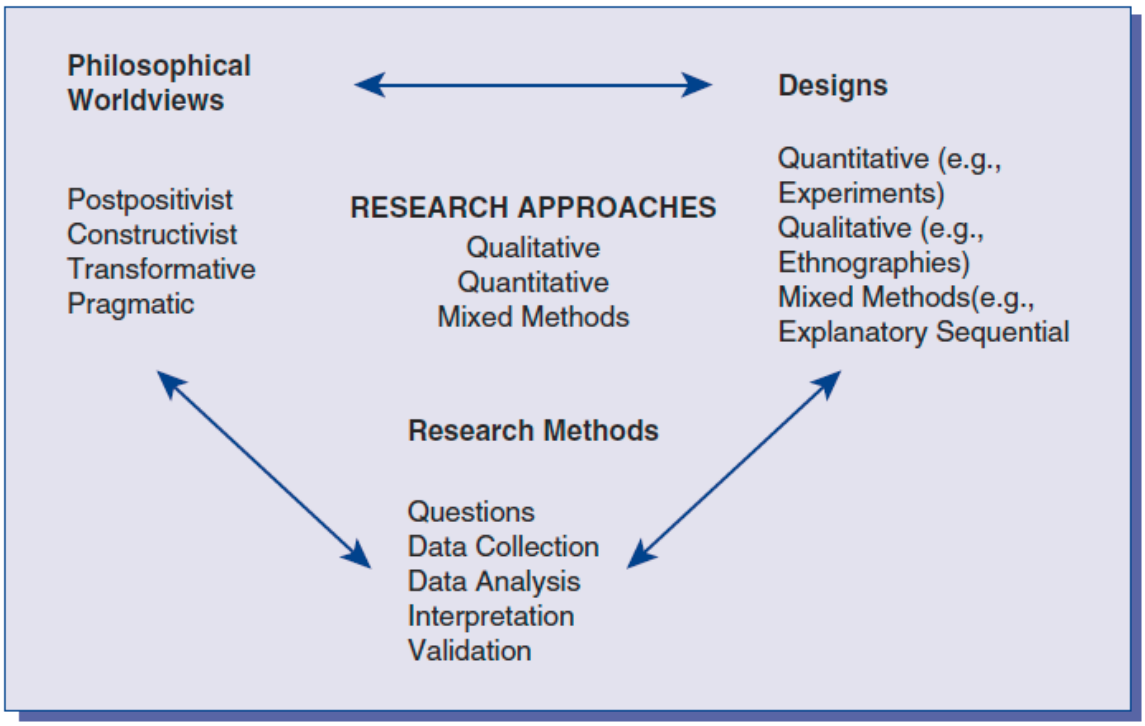

Figure 3.3: A Framework for research philosophy (Source: Slife & Williams, 1995)

3.3.1.1. EPISTEMOLOGY

Epistemology concerns what constitutes acceptable knowledge in a field of study (Saunders et al. 2009). Killam (2013) agrees with Saunders et al. (2009) in saying that as far as epistemology is concerned, the researcher considers, “What is knowledge? What are the sources and limits of knowledge?”. Killam (2003) continues to define epistemology as a philosophical viewpoint, which studies the relationship between knowledge and the researcher at the time of the discovery and denotes how we come to know what we know. The three possible philosophies associated with epistemology are interpretivism, positivism and realism.

(i) Interpretivism

Walshman (1993) attests that Interpretivism is of the belief that “knowledge of reality, including the domain of human action, is a social construction by human actors and that this applies equally to researchers”. Walshman (1993) further argues that there is no objective reality that can be discovered by researchers and reproduced by others, in contrast to the assumptions of positivist science. It is imperative, therefore, that the researcher clearly comprehends the differences between humans in their roles as social actors (Saunders et al. 2009).

Interpretivists oppose the idea that it is only through the subjective interpretation of, and involvement in, can reality be fully understood. Interpretivism is an epistemological position, concerned with methods of comprehending reality and affirming that all such knowledge is essentially a social construction, therefore, subjective. Although interpretivists accept the possibility of more than just one interpretation of reality, they maintain, however, that such interpretations are a part of the scientific knowledge being pursued.

(ii) Positivism

Positivists believe that observations, followed by measurements, are the core of scientific research (Eriksson and Kovalainen, 2008). Positivism questions the idea of a single, shared reality. It makes the argument that the known and the knower cannot be separated. Positivism may thus be viewed as a social research approach that applies the natural science model of research as the starting point for research of social experiences and explanations of the social world. Saunders et al. (2009) state that another important element to the positivist approach to research is that the research is carried out as far as possible, in a value-free manner.

Positivist researchers are of the view that it is possible to assume a neutral position. Such position thus enables the researcher to take on the role of an objective analyst, making unbiased interpretations about the collected data in a value-free manner. It is for the same reason positivists prefer an analytical interpretation of quantifiable data (Druckman, 2005). They are also of the view that the right kind of data collection instrument and tools are required to produce the truth for specific inquiry. Positivism deems human behaviour as controlled and determined by the external environment, therefore it is passive. Figure 3.4 shows the difference between positivism and interpretivism as described by Pizma and Manfeld (2009:1 as cited by Dudovskiy 2015.

This study adopted a positivist philosophical stance whereby the researcher assumed the role of an objective analyst.

Table 3.1: Positivism versus interpretivism (Source: Pizma & Mansfeld, 2009)

POSITIVISM VS. INTERPRETIVISM

Assumptions	Positivism	Interpretivism
Focus of interest	What is general, average and representative	What it specific, unique and deviant
Knowledge generated	Absolute Laws (time, context and value free)	Relative meanings (time, context, culture, value bound)
Subject/Researcher relationship	Rigid separation	Interactive, cooperative, participative
Nature of reality	Objective, tangible, single	Socially constructed, multiple
Goal of research	Explanation, strong prediction	Understanding, weak prediction
Desired information	How people think and do a specific thing, or have a specific problem	What some people think and do, what kind of problems they are confronted with, and how they deal with them

(iii) Realism

The essence of realism philosophy is the idea of independence of reality from the mind, thus realists contend the idea that only the mind and its contents exist (Saunders et al. 2009). Realism is similar to positivism in the sense that it relates to the scientific research approach.

There are two forms of realism, namely *critical realism* and *direct realism*. Critical realists' view is that what we experience are just images and sensations of reality and not the actual reality, they also point out how such senses often deceive us. Direct realism, on the other hand, argues, "What we see is what we get", implying that what we experience through our senses portrays reality (Eriksson and Kovalainen, 2008; Saunders *et al.* 2009).

3.3.1.2. ONTOLOGY

According to Saunders et al. (2009), ontology is concerned with the nature of reality. It raises questions of the assumptions the researcher has about the way in which the world operates, and the commitment held to specific views. In addition, ontology concerns the ideas about the existence of and the relationship between society, people and the world in general (Eriksson and Kovalainen 2008).

There are two main categories associated with ontology, namely subjectivism and objectivism. The subjectivist holds the view that social phenomena are created from the perceptions and subsequent actions of social actors, whereas the objectivist represents the position that social entities exist in reality outside of social actors (Saunders et al. 2009). This study aligned itself with an objectivist ontological standpoint.

3.4. RESEARCH APPROACH

Research approach, as defined by Creswell (2009), involves a blueprint for research that encompasses philosophical assumptions and articulates distinct procedures from broad assumptions to detailed methods of data collection, analysis and interpretation. The research design is applied to ensure that appropriate research methods are adopted in order to reach study objectives as set out in the first chapter.

The two types of research approaches, which suggest the direction to follow when conducting a scientific study, are inductive and deductive (Beisek, 2007). Where inductive approach concerns itself with the collection of experimental evidence and then only formulates a theory after having considered the evidence at hand; whereas deductive approach starts out with the formulation of the hypothesis based on a theory that already exists.

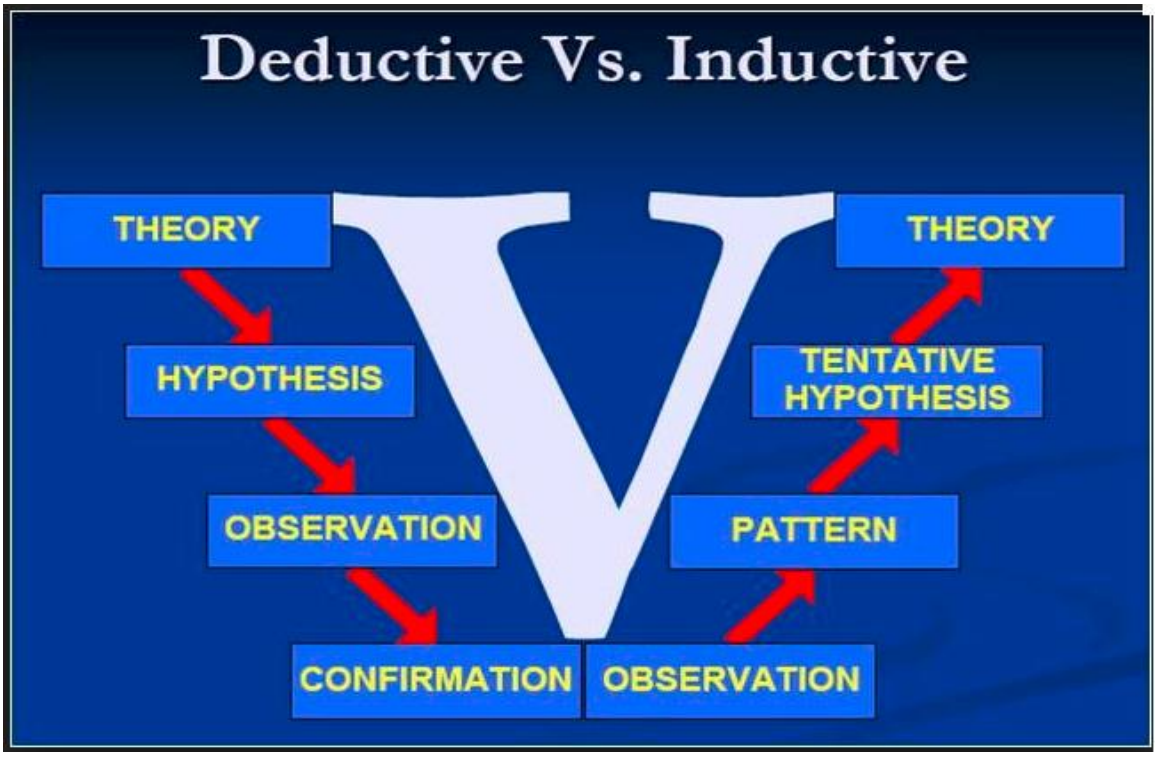

Figure 3.4: Deductive research approach versus inductive research approach (Source: Beiske, 2007)

A research study employing an inductive approach is more concerned with the setting in which such events occurred. Therefore, a study of a small sample of subjects might be more fitting for a study using an inductive approach than a large number, as with the deductive approach.

This study adopted a deductive research approach. The researcher distributed a questionnaire through a link to student of different levels at a selected UoT in South Africa and assumed the role of an observer and objective analyst of trends in a natural setting.

3.4.1. QUANTITATIVE RESEARCH METHOD

A quantitative research method, as attested by Mafuwane (2011), is an approach to research with the intention of theory/model testing, demonstrating relationships between components, determining facts and ultimately predicting outcomes. Antwi and Hamza

(2015) in concert with Mafuwane (2011) state that the quantitative research approach primarily follows the scientific method because it focuses on hypothesis testing and theory testing.

The quantitative research method depends on collecting quantitative data (numerical data) and follows other characteristics of the quantitative research approach. It uses numbers to measure data validity and reliability. Among other data collection techniques, quantitative researchers use experiments, questionnaires and surveys to collect data.

Quantitative research often uses what might be referred to as a “narrow-angle lens” because its emphasis is often on only one or a few underlying factors at the same time (Antwi & Hamza 2015). Quantitative researchers operate under the assumption of objectivity whereby their assumption is that there is a reality to be studied and that observers observing the same subject of study will essentially arrive at the same conclusion on its existence and its characteristics.

Benefits of quantitative research include:

- Because of the nature of its sample, which is normally large, randomly selected and considered as a representation of total population, results in qualitative research produce quantifiable and reliable data, which can be generalised to a larger population (Weinreich, 1996).
- Quantitative research is to be based on the positivist paradigm of measuring variables (Queirós et al. 2017).

The study adopted quantitative the research method whereby quantitative data were collected by means of questionnaires. The researcher then measured components on a sample of subjects and expressed the relationship between such components using statistical analysis such as relative frequencies, correlations and differences between means.

3.4.2. QUALITATIVE RESEARCH METHOD

Qualitative research method encompasses feelings and a direct involvement to identify the phenomena and suggest possible relationships between effects and causes (Kafilongo, 2016). Weinreich (1996) on the other hand, indicates that the qualitative research method is designed to provide the researcher with the viewpoint of target audience members through engagement in a situation and direct interaction with the people under study. This suggests that in a research study where qualitative method is adopted, the researcher assumes the role of both the object and the subject of his research. Results of qualitative studies may vary significantly depending on who conducts the research.

Qualitative research method is designed to assist researchers understand people and the social and cultural contexts within which they live (Myers, 2009); therefore, researchers using qualitative method aim to study subjects in their natural setting and then attempt to interpret experiences and events in terms of the meaning people bring to them. Qualitative research method affords the researcher the opportunity to understand social phenomena of various realities from respondents' perspectives.

Data sources for qualitative research include documents and texts, interviews and questionnaires, observation and fieldwork and the researcher's impressions and reactions. Unlike quantitative research, where results are represented by numerical or statistical data, qualitative research is concerned with aspects relating to reality that cannot be quantified; it therefore focuses on understanding and expressing the dynamics of social relations (Queirós et al. 2017). For this reason, results in a qualitative research are presented as a descriptive narration.

Benefits associated with qualitative research, as described by Queirós et al. (2017) and Denzin and Lincoln (2002) include:

- Qualitative research approach offers a detailed description of participants' opinions, experiences and feelings and interprets the meanings of their actions.

- ❖ Qualitative research approach, particularly interpretivism, is said to understand holistically human experience in specific settings.
- ❖ During the data collection, the researchers directly relates with the participants, as is the case when data collection is done through interviews, resulting in more detailed and subjective data.

Table 3.2: Qualitative research method vs. qualitative research method (Source: Kafilongo 2016)

Orientation	Quantitative	Qualitative
Assumption about the world	A single reality can be measured by an instrument	Multiple realities
Research Purpose	Establish relationships between measured variables	Understanding a social situation from participants' perspectives
Research methods and Processes	• Processes are established before study commences • A hypothesis is formulated before study commences • Deductive in nature	• Flexible, changing strategies • Design materialised as data are gathered • A hypothesis is not needed to commence with study • Inductive in nature
Researcher's role	The researcher is ideally an objective observer who does not take part or effects what is being explored.	The researcher takes part and becomes absorbed in the research/social setting.
Generalisability	Worldwide context-free generalisations	In-depth context-based generalisations

3.5. DATA COLLECTION

Data collection is considered one of the most vital phases in conducting a research. It is defined as a way by which information on variables of interest is collected and measured, in a systematic manner that enables the researcher to answer research questions, test hypothesis and eventually evaluate the results (Kabir, 2016)

3.5.1. SUBJECTS OF RESEARCH

The subjects in this research are both undergraduate and postgraduate students who were enrolled for different modules in the information and communication department (ICT) at one of the UoTs in South Africa.

3.5.2. POPULATION

The research population comprises of individuals who have precise characteristics that represent all the measurements of interest to the study (Strydom et al. 2005). The research population of this study consisted of the students at a UoT. The students were selected from one UoT in Gauteng province, South Africa.

3.5.3. SAMPLE TECHNIQUES

Singh (2006) states that a research study cannot be conducted without the use of sampling as it is considered a vital technique of behavioural research. In addition, Singh (2006) points out that the objective of sampling is to allow for accurate and cost-effective research findings, as it would not only be impractical but impossible to conduct research and collect data from the total population. Therefore, selecting a study sample for a research study is crucial. The sample observations serve as an estimate of the population's characteristics (Kafilongo, 2016). This can be seen in figure 3.5 where the sample is derived from the population and the results from the sample can then be generalised.

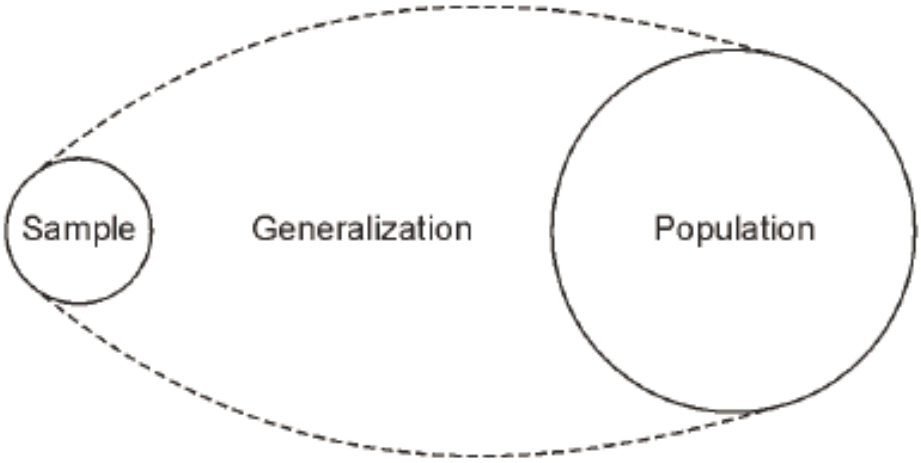

Figure 3.5: Example of sampling (Source: Kafilongo, 2016)

Figure 3.6 shows two types of sampling; probability and non-probability. Their merits and demerits are explained below.

Saunders et al. (2009) also state that with non-probability sampling, the probability of each case being selected from the total population is not known and it is impossible to answer research questions that require you to make statistical interpretations about the characteristics of the population.

With probability sampling, the probability or the chance of each case being selected from the total population is known and equal for all cases (Taherdoost, 2016). This implies that it is possible to achieve objectives that need you to estimate statistically the characteristics of the population from the sample. It is for this reason, that probability sampling is often linked to experimental and survey research strategies. Taherdoost (2016) adds that probability or random sampling has the highest freedom from bias; it may represent the most expensive sample with regards to the time and energy for a given level of sampling error.

Taking into consideration our research problem and objectives, probabilistic sampling was found to be the most appropriate sampling technique for this study.

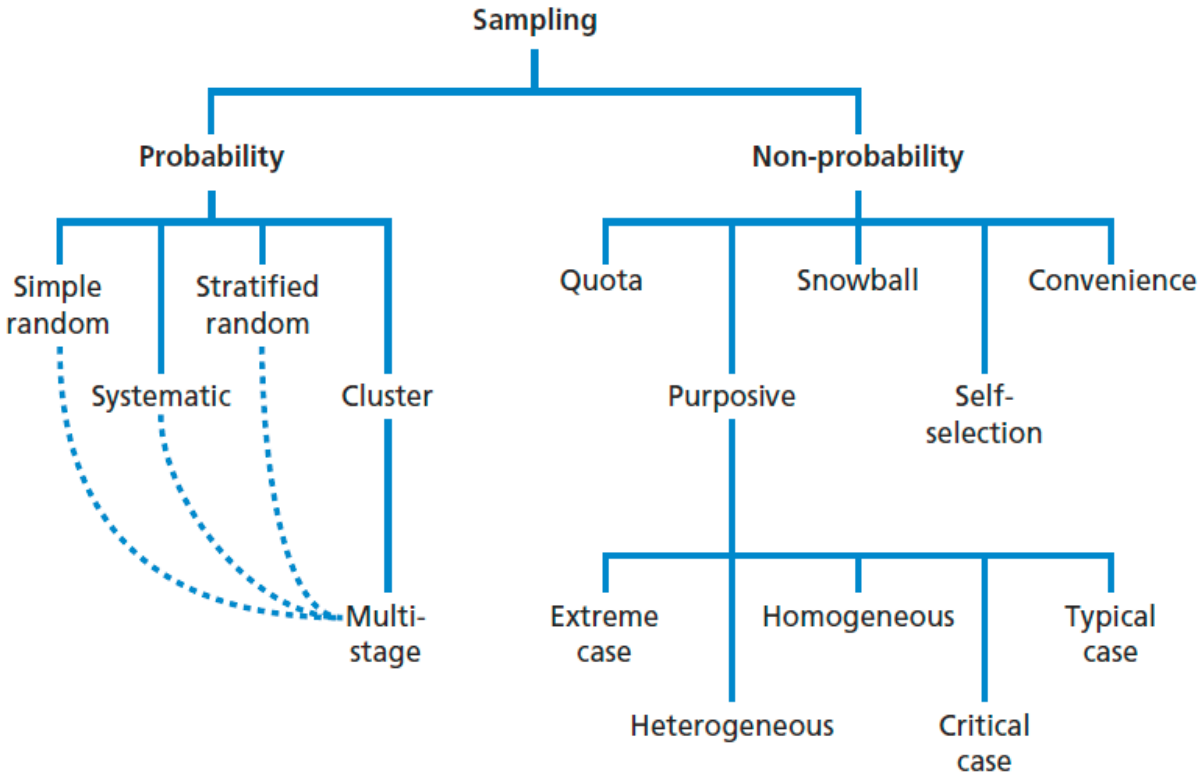

Figure 3.6: Sampling Techniques (Source: Saunders et al. 2016)

3.5.4. SAMPLE SIZE

To be able to generalise and avoid biases or sampling errors, the sample needs to be of a satisfactory and acceptable size. What constitutes acceptable depends on various factors. The larger the sample size the less errors. The sample population in this study are students enrolled for different levels in the ICT department at one of the UoTs in South Africa.

The questionnaire was distributed through a link towards the year-end examination period and was open for a period of four weeks (Tarhini et al. 2016). To distribute the link, the researcher was assisted by lecturers teaching different subjects and levels. During this

time of the academic year, student's attendance is low, hence the response rate was low (66 students responded). However, out of the 66 students' who responded, only 64 responses were valid. In addition, participation was voluntary, therefore, the students could choose to participate or not.

Similar studies conducted by various researchers in the same research focus area had a approximately the same sample size (Martin et al. 2013, Samarawickrema & Stacey 2007).

3.5.5. DATA COLLECTION INSTRUMENT

The data collection instrument used for this study is a questionnaire. The questionnaire was created using Google forms and the link was posted online for the participants (students) to access in their own time.

The questions used in the questionnaire were modified and adopted from prior studies (Nyeko and Ogenmungu, 2017b, Park and Kim, 2014, Lorenzo-Romero et al. 2014, Davis, 1989) mainly from technology adoption studies. Table 3.3 contains a list of items developed for each construct in the study, along with similar studies from which they were adopted.

Table 3.3: Questionnaire items

Construct	Items	Sources
Demographics Information	User gender, Age, Ethnic group, Level of study.	(Nyeko and Ogenmungu, 2017b, Erasmus et al. 2015)
Perceived usefulness of mobile learning	PU1: I think that using mobile learning improves my learning. PU2: I think that mobile learning is useful in my studies.	(Davis, 1989, Park and Kim, 2014, Park, 2011)

	PU3: Using mobile learning raises our chances to increase our academic effectiveness and performance. PU4: I think that the benefits of using mobile learning outweighs the disadvantages. PU5: I think that using mobile learning enables us to access a lot of academic information	
Perceived ease of use of mobile learning	PEOU1: I that using mobile learning is easy. PEOU2: I think that it is easy to get our study materials using mobile learning. PEOU3: I think interacting with mobile learning is clear and understandable. PEOU4: I think that it is possible to use mobile learning without expert help.	(Davis, 1989, Lorenzo-Romero et al. 2014, Davis et al. 2006)
Perceived connectedness	PC1: I feel like I am connected to external reality because I can search for desired study information. PC2: I feel good because I can access study materials anytime via mobile devices. PC3: I feel emotionally comforted because I can do my assessments with mobile learning at my convenience.	(Park and Kim, 2014, Shin, 2010)

Perceived mobility	PM1: Mobility of mobile learning services makes it possible to acquire up-to-date study material. PM2: It is convenient to use mobile learning services anytime and anywhere. PM3: Mobility is an outstanding advantage of mobile devices offering mobile learning services.	(Park and Kim, 2014)
Service & system quality	SSQ1: Mobile devices with mobile learning services provide more services in line with the purpose of the system. SSQ: I have not had any limitations or problems with using mobile learning services. SSQ3: Mobile devices with mobile learning services fully meet my academic needs.	(Park and Ki Joon Kim, 2013, Park and Kim, 2014)
Attitude towards mobile learning	ATT1: I have positive feelings toward mobile learning services in general. ATT2: It is a good idea to use mobile learning services. ATT3: I think it is desirable to use mobile learning as opposed to traditional learning.	(Davis, 1989, Davis et al. 2006, Lorenzo-Romero et al. 2014)
Intention to adopt mobile learning	IA1: I intend to use mobile learning services as much as possible. IA2: I will continue to use mobile learning services if I have access to the service.	(Park and Ki Joon Kim, 2013, Davis, 1989, Lorenzo-Romero et al. 2014)

	IA3: I will recommend others to use mobile learning.	

3.6. QUESTIONNAIRE

The questionnaire is regarded as a means by which data are collected in survey research. It contains a set of questions; which participants respond to on the questionnaire form itself without the researcher's assistance. It is also referred to as a method through which verbal or written responses are collected from research participants through a set of statements or questions (Nyakala, 2013). The primary aim of a questionnaire is to obtain facts and opinions about a phenomenon from people who are informed on a specific subject (Vicente, 2013).

Questionnaires consist of open-ended or closed-ended questions, for obtaining demographic information and data that may be easily categorised (McMillan and Schumacher, 2006). Closed-ended questions are used when all possible, applicable responses to a question can be specified and the number of possible responses is limited, whereas open-ended questions are best used when there are several possible answers (Vicente, 2013).

The decision to use a questionnaire as the data collection instrument was influenced by how easy questionnaires are to use and how economical they are. The students were able to complete the questionnaire in a short period of time without interfering with their studies.

3.6.1. QUESTIONNAIRE DESIGN

In order to achieve the objective of the study, the researcher conducted an extensive literature review. The researcher then utilised research guidelines and the literature sources to design a self-administered questionnaire. The questionnaire consisted of closed-ended questions, where fixed responses from which participants were to select

were provided. The items used to measure the constructs in the questionnaire were identified and adopted from previous similar studies (Park and Kim, 2014, Lorenzo-Romero et al. 2014, Han and Han, 2014, Martin et al. 2013, Al-alak and Alnawas, 2011, Chin and Lin, 2016, Nyeko and Ogenmungu, 2017b)

The researcher developed the questionnaire using a five-point Likert scale and each response was assigned a numeric value/score ranging from one to five; one representing strongly disagree and five strongly agree. Sullivan and Jr (2013) allude that a Likert-type scale is generally associated with a series of statements intended to measure the level of agreement, attitudes or perceptions and five-point or seven-point scales are usually used. The main objective of the questionnaire was to help the researcher acquire insight regarding participant's perception when it comes to the adoption of mobile learning at UoTs in SA. The questionnaire consisted of two (2) sections:

Section A: **Demographic information:** This section of the questionnaire collected information about demographics of the participants. The information collected included, age, gender, ethnic group and level/year of study. To encourage honest responses, participants were guaranteed anonymity; therefore, no names were collected.

Section B: **Technology adoption related questions:** This section of the questionnaire helped acquire information relating to the participant's perception of mobile learning adoption and their intention to adopt. It was based on the following items: perceived mobility of m-learning, perceived connectedness of m-learning systems, perceived ease of use of m-learning, perceived usefulness of m-learning, service and system quality of m-learning, attitude towards m-learning and the intention to adopt m-learning. The five-point Likert scale was utilised to determine the participant's degree of agreement.

Having conducted an extensive literature review by studying commonly applied technology adoption theories, it was noticeable that various authors of such theories were in agreement in that two key variables, namely perceived ease of use and perceived

usefulness proved to be of greater importance and are direct determining factors of both technology acceptance and adoption in many models tested.

3.6.1.2. BENEFITS AND LIMITATIONS OF QUESTIONNAIRE

Below are some of the benefits and limitations associated with questionnaires, as described by Debois (2016).

(i) Benefits

- **Questionnaires are economical** – They are the most cost-effective way of collecting quantitative data, especially online questionnaires since the printing costs are completely eliminated.
- **Questionnaires offer speedy results** – Depending on the reach and scale of the questionnaire, an online questionnaire allows for collection of needed data in the shortest possible time frame.
- **Questionnaires are practical** – Despite being flexible and economical, questionnaires are a practical technique to collect quantitative data as they can be targeted to a specific sample.
- **Scalability** – Questionnaires offer the researcher an opportunity to collect data from a sizeable population.
- **User anonymity** – Questionnaires allow respondents to remain anonymous, which in turn puts them at ease, maximises comfort and encourages them to give a truthful response.

(ii) **Limitations**

- **Differences in understanding and interpretation** – With the researcher not being present to explain the questions and ensure that every respondent has the same understanding, each respondent may have a different interpretation of the questions.
- **Hard to convey feelings and emotions** – Questionnaires can never entirely capture the feelings and emotional responses of the respondents.

- **Dishonesty** – Respondents may not be completely truthful in their responses.
- **Skipped questions** – There is always a chance of questions being left unanswered.

3.7. PROPOSED MOBILE LEARNING MODEL

The research model used in this study was derived and adopted from TAM3 and ETAM as proposed by Rogers (2010) and (Park and Kim, 2014) as shown in figure 3.7.

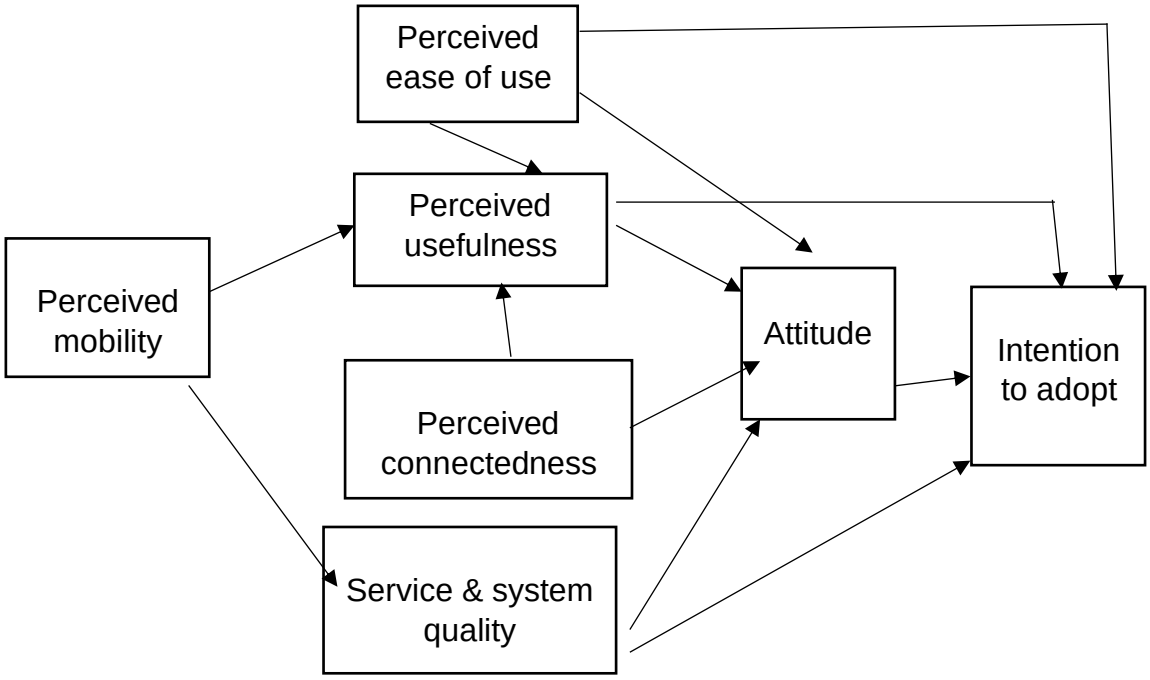

Figure 3.7: Proposed research model

3.8. DATA ANALYSIS

Data analysis relates to the application of reasoning in order to understand the collected data, in the effort to finding the tests of associations and basic concepts. The data for this study were gathered by means of questionnaires. Data were captured in Excel and were later exported to SPSS version 25.0 for quantitative analysis.

3.8.1. VALIDITY AND RELIABILITY

Validity and reliability are important concepts used in quantitative research to evaluate the quality of research. They give an indication of how well a technique measure something. An in-depth discussion of these concepts is provided in sections below.

3.8.1.1 Validity

Validity, as defined by Aila and Ombok (2015), refers to the degree that an instrument measures what it is designed or intended to measure. Validity is concerned with the significance and relevance of research components, which suggests that measurement must be both valid and reliable. It can be concluded that validity relates to the extent to which an instrument measures what it was intended to measure.

The six validity types in figure 3.8, as discussed by Aila and Ombok (2015), Trochim and Donnelly, 2006, Zikmund et al. 2009), are content validity, concurrent and predictive validity, face validity and convergent and discriminant validity. Content validity refers to the kind of validity where the area of the concept is made clear and the researcher determines whether the measures fully represent the area of concept. Concurrent validity relates to the ability of a test to predict an event in the present, while predictive validity refers to the ability of a test to measure outcome in the future (Aila and Ombok, 2015). Face validity is a subjective judgment on the operationalisation of a construct, therefore, is considered a weak form of construct validity (Drost, 2011). The questions used in the design of the questionnaires for this study, were adopted from previously validated studies (Park and Kim, 2014, Lorenzo-Romero et al. 2014).

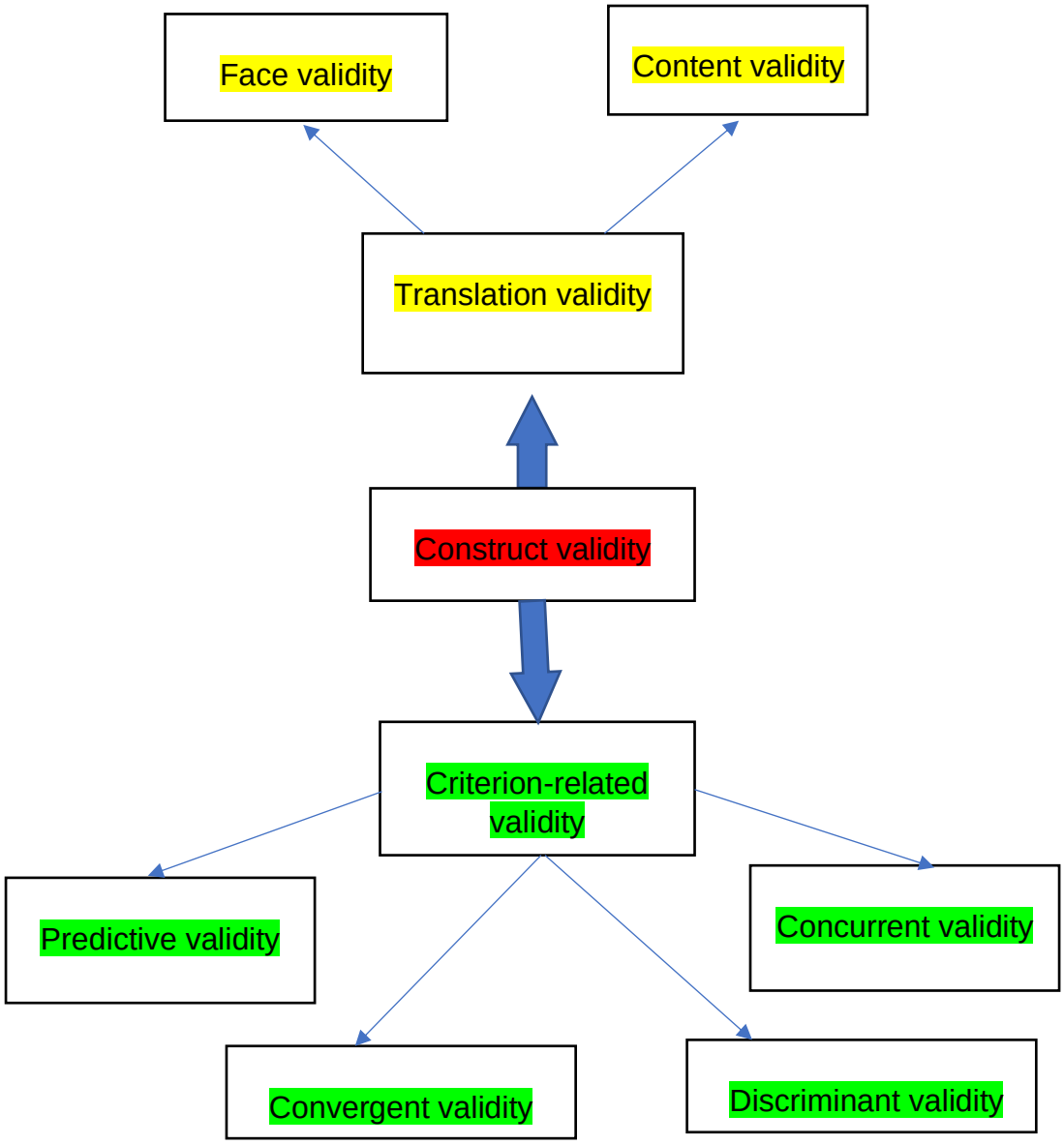

Figure 3.8: Construct Validity Types (Source: Aila & Ombok, 2015)

3.8.1.2. Reliability

Reliability of the questionnaire in this study was conducted by means of Cronbach's α efficient as proposed by Cronbach in 1951. With regards to social studies, Cronbach's α efficient is considered the most frequently used measure of reliability. Social studies use

reliability in order to ensure the consistency of the findings for the various elements being tested within each factor (Sharma, 2016). It is normally evaluated by assessing the internal consistency of the elements representing each variable using Cronbach's α.

To ensure consistency of the questionnaire the Cronbach's alpha analysis was performed to certify that the constructs are measuring the same thing. In social science studies Cronbach's α efficient is the most generally used measure for reliability as indicated by Sharma (2016). Table 3.4 shows various Cronbach's levels for reliability.

Table 3.4: Reliability levels

Reliability	Range
Unreliable	α ≤0 .30
Barely reliable	0.30 < α ≤ 0.40
Slightly reliable	0.40< α ≤0.50
Reliable (most common range)	0.50< α ≤0.70
Very reliable (second most common range)	0.70 < α ≤0.90
Strongly reliable	α >0.90

3.8.1.3. Correlation

Pallant (2016) states that the Bartlett's test is done to check whether the observed correlation matrix $R = (ri_j)(p \times p)$ deviates significantly from the identity matrix. To measure the overall relationship between the technology adoption variables, we worked out the determinant of the correlation matrix |R|. Under H1, |R|=1: If the variables are highly correlated, we have $|R| \approx 0$. The Bartlett's test static gives an indication as to what extent we deviate from the reference point $|R| = 1$. Below is the formula used:

$$x^2 = -\left(n - 1 - \frac{2p+5}{6}\right) \times 1n|R| \qquad \textbf{Equation 1}$$

Furthermore, to evaluate the proposed framework and determine whether there is any relationship between the technology adoption related factors, Pearson correlations were

conducted. Pearson correlation coefficient is a technique used to examine the relationship between two continuous, quantitative variables (Gogtay and Thatte, 2017). However, it does not try to establish whether there are dependent and independent variables, instead it measures the strength of the association between the two variables. It uses the following formula:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{\left[n\sum x^2 - (\sum x)^2\right]\left[n\sum y^2 - (\sum y)^2\right]}}$$ **Equation 2**

3.8.1.4. Regression

Multiple linear regression was applied between dependent and independent variables to test the hypotheses in this study (Figure 3.9). Dependent variables refer to variable whose value is to be predicted is known, whereas the variables whose values are known and are used for prediction are referred to as independent variables (Gupta and Dubey, 2016). In this study, dependent variable IA (intention to adopt) is displayed as a function for two independent variables (perceived ease of use of mobile learning and attitude toward using mobile learning and service). PU (perceived usefulness) is displayed as a function for three variables (perceived mobility and perceived ease of use) and ATT (attitude towards mobile learning) has the following dependents: perceived usefulness, behavioural beliefs and normative beliefs. Regression analysis is a statistical practice used to relate variables; it aims to provide a mathematical model to relate dependent variables to independent variables. A regression model will generally be defined as a single mathematical equation of the form (Anghelache and Sacala, 2016).

Anghelache and Sacala (2016) also attest that multiple linear regression is referred to multiple independent variables used as predictors for the value of a dependent variable. It is also considered the clear and understandable generalisation of simple regression to the circumstances where there is more than one predictor. Multiple linear regressions are used for displaying the relation between two or more explicative variables and the responses variables by classifying a linear equation between the data being observed.

Each value of the independent variable χ is associated with a value of dependent variable y. In addition, Anghelache and Sacala (2016) confirm that the individual values of the registered explanatory variables within the linear regression $\chi_1, \chi_{2...} \chi_p$ are defined as:

$$\gamma = bx + a$$ **Equation 3**

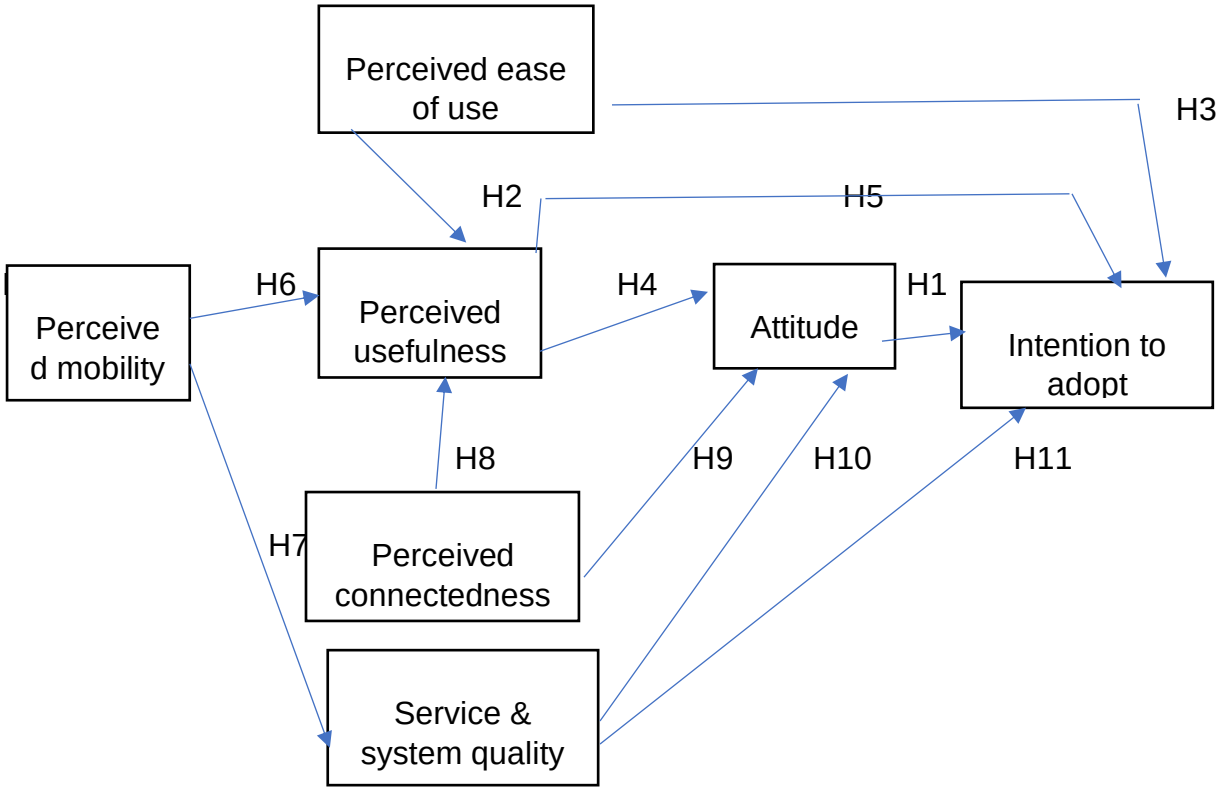

Figure 3.9: Study hypothesis

Having reviewed previous similar studies and literature review, we arrived at the following hypothesis as in figure 3.9:

(i) Attitude towards mobile leaning

Attitude refers to the degree to which a person has optimistic or pessimistic evaluation of the behaviour of interest (Dai, 2015, Ajzen, 1991, Matikiti et al. 2018). It involves a

reflection of the consequences of performing the behaviour; therefore, the behavioural intention to adopt a new technology is influenced by attitude toward such technology. Therefore, the following hypothesis was tested:

H1: Attitude toward mobile learning has a significant and positive influence on the intention to adopt mobile learning.

(ii) Perceived ease of use of mobile learning

In a study carried out by Dai (2015), perceived ease of use is said to have a great significant effect on attitude. Dai (2015) also defines perceived ease of use (PEOU) as the degree to which a person believes that using a system would require minimum to no effort. A complicated mobile learning system may prevent users from adopting mobile learning. In line with that, perceived ease of use is acknowledged as a positively influencing factor for users' intention to adopt new technology (Goswami, 2017). The study hypothesises that perceived ease of use of mobile learning will have a positive influence on users' perceived usefulness of mobile learning and on intention to adopt mobile learning. Hence, the following hypotheses were tested:

H2: Perceived ease of use of mobile learning has a significant and a positive influence on the perceived usefulness of mobile learning.

H3: Perceived ease of use of mobile learning has a significant and positive influence on the intention to adopt mobile learning.

(ii) Perceived usefulness of mobile learning

A study conducted by Chin and Lin (2016) defines perceived usefulness as the degree to which a user has confidence in that using a particular system will enhance his or her job performance. The main motive for users to engage in mobile learning is because they find mobile learning to be both useful and convenient. Therefore, the following hypotheses were tested:

H4: Perceived usefulness of mobile learning has a significant and positive influence on the attitude toward mobile learning.

H5: Perceived usefulness of mobile learning has a significant and positive influence on the intention to adopt mobile learning.

(iii) Perceived mobility

Jen-Hung et al. (2007) defines perceived mobility as the user's awareness of the mobility value of mobile learning. With this definition on perceived mobility in mind, the following hypotheses were tested:

H6: Perceived mobility of mobile learning has a significant and positive influence on the perceived usefulness of mobile learning.

H7: Perceived mobility has a significant and positive influence on service and system quality.

(iv) Perceived connectedness

In a communal environment, users communicate and share with others via a particular system. Users' perception of connectedness is that users are emotionally connected with the world, its resources and people (Park and Kim, 2014).

H8: Perceived connectedness has a significant and positive influence on the perceived usefulness of mobile learning.

H9: Perceived connectedness has a significant and positive influence on attitude toward mobile learning.

(v) Service & system quality

System and service quality, according to Park and Kim (2014), refers to "the perceived level of general performance of a particular system and its service". Park and Kim (2014) further add that there is a positive relationship between the quality of the system and

service and the user' perceptions of that system and service. The following hypotheses were tested:

H10: Service and system quality has a significant and positive influence on the attitude toward mobile learning.

H11: Service and system quality has a significant and positive influence on the intention to adopt mobile learning.

(vi) Intention to adopt mobile learning

A study conducted by Alsamydai (2014) indicated that behavioural intention to use refers to a person's inclination to perform or not to perform a specific future behaviour. Therefore, behavioural intention to use is significantly influenced by perceived usefulness and attitude toward using, note Guritno and Siringoringo (2013).

3.9. ETHICAL CONSIDERATIONS

Ethical considerations relate to the issue of moral standards, which are to be taken into consideration by the researcher throughout all stages of research. The purpose of the study was explained to all participants before the commencement of the study and anonymity was guaranteed. In addition, participants were assured that the information gathered was not be used against them and was not be used for anything else other than the purpose of the study. No names were required while filling out the questionnaire. All participants participated voluntarily and willingly, without any kind of incentive.

3.10. CONCLUSION

This chapter outlined the research design, philosophy, approach, methodology, data collection and data analysis methods and hypotheses of this study that delves into the adoption of mobile learning at the UoT in South Africa. The study aligned itself with a positivist epistemological stance, objectivism ontological standpoint and adopted deductive research approach. In addition, the chapter discussed the proposed research model for the study.

CHAPTER 4: DATA ANALYSIS AND RESULTS

4.1. INTRODUCTION

This chapter presents the results of data that were studied. The data for this study were gathered by means of questionnaires and SPSS was utilised for quantitative analysis. The questionnaire consisted of two sections where Section A gathered key demographic variables such as level of study, age, gender and ethnic group. Section B of the questionnaire focused on the purpose of the study, which is investigating the adoption of mobile learning at a UoT in South Africa. For each item of section B of the questionnaire, a five-point Likert scale ranging from one to five, where one represents strongly disagree and five strongly agree was used and processed in response to the problem stated in the first chapter of the study.

4.2. RESPONSE RATE

The returned questionnaire percentage is worked out as the number of returned questionnaires divided by sample size multiplied by 100, as alluded to by Mavletova (2013). Sixty-eight (68) sample size was randomly selected for this study; all 68 of them were returned, making the response rate 100%. However, two (2) of the responses were found to be incomplete, therefore, were not included in the analysis. Consequently, only 66 questionnaires, which represents 96.9% of the sample, were analysed.

Rindfuss et al. (2015) state that where the study seeks to make generalisations to a bigger sample, response rates are more imperative. In support of Rindfuss et al. (2015), Hardigan et al. (2016) stated that for electronically completed questionnaires, the average response rate is between 30 and 40 percent. Petrovcic et al. (2015) added that a response rate below 30 percent means that validity and the value of the findings and methods are questionable. With the response rate of 96.9%, this study met and surpassed the average response rate target of 30-40%.

4.3. RELIABILITY TEST RESULTS

To measure and determine the internal consistency between all the constructs of this study, Cronbach's α was used. The rule of thumb with regards to the reliability test, as alluded to by Alwan and Al-Zu'bi (2016), is that 0.70 or higher represents highly consistent and reliable. The results represented in Table 4.1 indicate that the Cronbach's α for all constructs in this study are highly reliable as all values are above 0.70.

Table 4.1: Reliability statistics for study constructs

Construct	No. of items	Cronbach's α
Perceived usefulness of mobile learning	5	0.915
Perceived ease of use of mobile learning	4	0.852
Perceived mobility	3	0.832
Perceived connectedness	3	0.849
Service & system quality	3	0.854
Attitude	3	0.883
Intention to adopt mobile learning	3	0.881

4.4. VALIDITY TEST RESULTS

Heale and Twycross (2015) define validity as the extent to which a concept is accurately measured in a quantitative study; whether data accurately represent what the researcher intended them to represent. Heale and Twycross (2015) went on to add that content validity is a category of validity that looks at whether the instrument effectively covers all the content that it is intended to cover with respect to the variable. In the context of this study, the issue is whether the respondents responded to the questions consistently and honestly. The questionnaire was then formulated in a way that it measured all variables included in mobile learning adoption model, thus ensuring content validity.

Factor analysis through the principal analysis (PCA) was employed to determine the fundamental variable of the research study. PCA allows for an assessment to both the

convergent and discriminant validity, it is for this reason that it was selected. Prior to conducting the factor analysis, a Kaiser-Meyer-Olkin test of sampling adequacy and a Bartlett test was evaluated to make sure that the sample size is acceptable to support factor analysis as a result of the number of variables. As depicted in Table 4.2 below, the chi-square is at 15834.834 with 412 degrees of freedom that is significant at 0.000 level of significance coupled with a Kaiser-Meyer-Olkin of 0.769 that justifies the factor analysis in this research as it is above 0.50. Based on the above breakdown of KMO sampling adequacy and Bartlett's test, the factor analysis for adoption of mobile learning questionnaire is regarded a suitable technique for further data analysis.

Table 4.2: Kaiser-Meyer-Olkin and Bartlett's test

Kaiser-Meyer-Olkin and Bartlett's test	**Results**
KMO measure of sampling adequacy	0.769
Bartlett's Test of sphericity: Approximately Chi-Square	15834.834
: Df.	412
: Sg.	0.000

Table 4.3 below depict the factor loading of the principal components. To interpret the factor loading, the research followed recommendations from Anderson et al., (2010). According to recommendations, any items are viewed as practically significant if their load values are above 0.5. A cut-off value of less than 0.5 was subsequently implemented in this research study. Palvia and Aladwani (2002) state that any value that did not load strongly (any factor less than 0.5) must be eliminated, this principle was applied in this study. All factors in this study loaded above the recommended threshold and are therefore all accepted.

Table 4.3: Principal Components Analysis (Factor loading)

Variables	PU	PEOU	PM	PC	SSQ	ATT	IA
Perceived Usefulness							
PU1	0.823						
PU2	0.843						
PU3	0.728						
PU4	0.679						
PU5	0.590						
Perceived Ease of Use							
PEOU1		0.898					
PEOU2		0.861					
PEOU3		0.789					
PEOU4		0.578					
Perceived Mobility							

PM1			0.914				
PM2			0.923				
PM3			0.847				
Perceived Connectedness							
PC1				0.897			
PC2				0.896			
PC3				0.841			
Service & System quality							
SSQ1					0.898		
SSQ2					0.851		
SSQ3					0.587		
Attitude							
ATT1						0.716	

ATT2						0.868	
ATT3						0.816	
Intention to Adopt							
IA1							0.628
IA2							0.820
IA3							0.707

Legends: PU = Perceived Usefulness; PEOU = Perceived Ease of Use; PM = Perceived Mobility; PC = Perceived Connectedness; SSQ = Service & System Quality; **ATT = Attitude, IA = Intention to Adopt.**

4.4.1. CONVERGENT AND DISCRIMINANT VALIDITY ASSESSMENT

Construct validity was determined to ensure that variables have been accurately measured. Construct validity refers to the extent to which an instrument is measuring what it claims to be measuring. This study utilised two types of construct validity, namely convergent and discriminant validity.

Convergent validity indicates the extent to which scores on a specific test correlate with scores on another test intended to measure the same construct. Whereas discriminant validity indicates the extent to which scores on a certain test do not associate or correlate with scores from another test that are not designed to assess the same construct. According to Anderson et al., (2010), for the convergent validity to be acceptable, the composite reliability must be greater than 0.7 and the composite reliability must be greater

than the average variance extracted values. As depicted in Table 4-4 both measurements were met.

The convergent validity determines the extent to which procedures of construct are correlating with the average variance extracted (AVE), whereby AVE ought to be greater than 0.5 (Anderson et al., 2010). According to Anderson et al., (2010) the discriminant validity that denotes the extent to which the construct vary from each other should only be established if all constructs share variance individual's items. The above statement can be verified by finding out whether the square root of the AVE is greater than the correlated construct's AVE (Karahanna and Agarwal, 2000). As depicted in Table 4-4, all AVE square roots are much higher than the inter-construct correlation. Therefore, the convergent validity and discriminant validity has been met.

Table 4.4: Validity Assessment

Convergent Validity			**Discriminant Validity**						
	CR	**AVE**	**PU**	**PEOU**	**PM**	**PC**	**SSQ**	**ATT**	**IA**
PU	.876	.579	**.760**						
PEOU	.814	.597	.082	**.772**					
PM	.932	.823	.052	.011	**.907**				
PC	.910	.649	-.005	-.003	.061	**.805**			
SSQ	.842	.597	.070	.091	.001	.052	**.772**		

ATT	.889	.680	.023	.083	-.008	051	.004	**.824**	
IA	.870	.670	.081	.072	.070	0.62	.094	**-**.002	**.818**

Legends: Composite Reliability (CR), Average Variance Extracted (AVE), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Perceived Mobility (PM), Perceived Connectedness (PC), Service & System Quality (SSQ), Attitude (ATT), Intention to Adopt (IA)

The numbers that are diagonal (in bolded shape) are the square root of each average variance extracted, whereas the non-diagonal numbers are inter-construct correlations. For discriminant validity to be acceptable the numbers in diagonal as indicated should be greater than the non-diagonal numbers.

4.5. DEMOGRAPHIC RESULTS

In an effort to elaborate on the participants' background, Section A of the questionnaire gathered the demographic information of the participants, including age, gender, ethnic group and level of study. The descriptive results are indicated by means of a frequency table. The analysis was carried out based on the 64 completed surveys that were accurately filled out by the students.

(i) Age distribution

With regards to age, 55 (85.9%) of the participants were between 18-25 years old and 9 (14.1%) were between 26-35 years old (Table 4.5).

Table 4.5: Age distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	55	85.9	85.9	85.9
	26-35	9	14.1	14.1	100.0
	Total	64	100.0	100.0	

(ii) Ethnic group distribution

Regarding ethnic groups, 61 (95.3%) of the participants were black, two (3.1%) were coloured and one (1.6%) of the participants was Asian. It is evident that the higher percentages were linked with black people, which is the dominant group at the location where the study was carried out (UoT in Gauteng province, South Africa) (Table 4.6).

Table 4.6: Ethnic group distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asian	1	1.6	1.6	1.6
	Black	61	95.3	95.3	96.9
	Coloured	2	3.1	3.1	100.0
	Total	64	100.0	100.0	

(ii) Level of study distribution

In terms of level of study, 12 (18.8%) of the participants were first-year students, 28 (43.8%) were postgraduate students and 24 (37.5%) participants were second year student. We can conclude that higher levels of study influence students to adopt mobile learning (Table 4.7).

Table 4.7: Level of study distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	First year	12	18.8	18.8	18.8
	Postgraduate	28	43.8	43.8	62.5
	Second year	24	37.5	37.5	100.0
	Total	64	100.0	100.0	

4.5.2. MOBILE LEARNING ADOPTION RELATED FACTORS RESULTS

The questions in section B of the questionnaire strived to determine the following:

- How UoT students perceive usefulness of mobile learning
- If UoT students' opinion towards mobile learning will assist in the recommendation of mobile learning adoption
- How will UoT students' opinion towards mobile learning help in establishing the relationships between the technology factors

The quantitative analysis in this section used a format of frequency tables, which indicates the actual perspectives of participants. A brief interpretation of the results is provided.

(i) Perceived usefulness of mobile learning

a) I think that using mobile learning improves my learning

Participants were asked to select the level of agreement with regards to the perceived usefulness of mobile learning statement appropriate to them; all the participants answered the question (64 responses). A sizeable group of 40 (62.5%) agree that they find using mobile learning useful in improving their learning. This was followed by 18 (28.1%) participants who strongly agree that they find mobile learning useful to improve their learning, three (4.7%) of the participants neither agree nor disagree that they find mobile learning useful to improve their learning and lastly, three (4.7%) participants strongly disagree that they find mobile learning useful to improve their learning. See Table 4.8.

TABLE 4.8: I THINK USING M-LEARNING IMPROVES MY LEARNING

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	4.7	4.7	4.7
	Neither Agree nor Disagree	3	4.7	4.7	9.4
	Agree	40	62.5	62.5	71.9
	Strongly Agree	18	28.1	28.1	100.0
	Total	64	100.0	100.0	

b) I think that mobile learning is useful in my studies

As shown in Table 4.6, 59.4% of the sampled population (38 participants) agree that they find mobile learning useful in their studies, 3.1% of the population (n=2) neither agree nor disagree that they find mobile learning in useful in their studies, while 3 participants (4.7%) strongly disagree that they find mobile learning useful in theirs studies, and lastly, 21 (32.8) participants strongly agree that they find mobile learning useful in their studies. See Table 4.9.

Table 4.9: I think m-learning is useful in my studies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	4.7	4.7	4.7
	Neither Agree nor Disagree	2	3.1	3.1	7.8
	Agree	38	59.4	59.4	67.2
	Strongly Agree	21	32.8	32.8	100.0
	Total	64	100.0	100.0	

c). Using mobile learning raises my chances to increase my academic effectiveness and performance.

Depicted in Table 4.10 are varying views of participants regarding their perception on the usefulness of mobile learning and its ability to increase their academic performance and

effectiveness. 53.1% of the population (n=34) agree that they find using mobile learning increases their chances to improve their academic performance and be more effective. 10.9% of the population (n=7) neither agree nor disagree, that they find that using mobile learning raises their chances to increase their academic performance. 4.7% of the population (n=3) strongly disagree that they find using mobile learning increases their chances to be more effective and improve academic performance, 1.6% of the population (n=1) disagree that they find using mobile learning increases their chances to be effective and improve academic performance, and 29.7% of the population (n=19) strongly agree that they find using mobile learning raises their chances to improve their academic performance and become more effective in their studies. See Table 4.10.

Table 4.10: Using m-learning raises my chances to increase academic performance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	4.7	4.7	4.7
	Disagree	1	1.6	1.6	6.3
	Neither Agree nor Disagree	7	10.9	10.9	17.2
	Agree	34	53.1	53.1	70.3
	Strongly Agree	19	29.7	29.7	100.0
	Total	64	100.0	100.0	

d) I think that the benefits of using mobile learning outweighs the disadvantages.

Table 4.11 shows the different views of participants with regards to the benefits of mobile learning. 33 participants (51.6%), agree that they find that the benefits of using mobile learning surpasses the limitations/disadvantages. 11 participants (17.2%) neither agree nor disagree that the benefits of using mobile learning surpasses the limitations, 3.1% of the population (n=2) strongly disagree and 3.1% disagree that they find the benefits of using mobile learning surpasses the limitations. Lastly, 25.0% of the population strongly

agree that the benefits of using mobile learning surpasses the limitations/disadvantages. See Table 4.11.

Table 4.11: I think the benefits of using m-learning outweigh the disadvantages

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	3.1	3.1
	Disagree	2	3.1	3.1	6.3
	Neither Agree nor Disagree	11	17.2	17.2	23.4
	Agree	33	51.6	51.6	75.0
	Strongly Agree	16	25.0	25.0	100.0
	Total	64	100.0	100.0	

e) I think that using mobile learning enables me to access a lot of academic information.

As represented in Table 4.12, 30 out of 64 participants strongly agree that they find that using mobile learning enables them to access a lot of academic information; this number represents 46.9% of the population. 2 participants (3.1%) neither agree nor disagree that they find that using mobile learning enables them to access more academic information, 28 (43.8%) participants agree that they find that using mobile learning enables them to access a lot more academic information, three (4.7%) participants strongly disagree and one (1.6%) participant disagrees that they find using mobile learning enables them to access more academic information. See Table 4.12.

Table 4.12: I think using m-learning enables me to access more academic information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	4.7	4.7	4.7
	Disagree	1	1.6	1.6	6.3
	Neither Agree nor Disagree	2	3.1	3.1	9.4
	Agree	28	43.8	43.8	53.1
	Strongly Agree	30	46.9	46.9	100.0
	Total	64	100.0	100.0	

(ii) Perceived ease of use of mobile learning

a) I think that using mobile learning is easy.

54.7% of the population (35 participants) agree that they find that using mobile learning is easy, 12.5 % (n=8) neither agree nor disagree that they find that using mobile learning is easy, 3.1 % (2 participants) strongly disagree that they find that using mobile learning is easy, 1.6% of the population disagree that they find that using mobile learning is easy and 28.1% of the population (18 participants) strongly agree that they find that using mobile learning is easy. See Table 4.13.

Table 4.13: I think using m-learning is easy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	3.1	3.1
	Disagree	1	1.6	1.6	4.7
	Neither Agree nor Disagree	8	12.5	12.5	17.2
	Agree	35	54.7	54.7	71.9
	Strongly Agree	18	28.1	28.1	100.0
	Total	64	100.0	100.0	

b) I think that it is easy to get our study materials using mobile learning.

35 participants (54.7%) strongly agree that they find it easy to access their study material with the help of mobile learning. 1.6% of the population (1 participants) disagree that they find it is easy to get their study material using mobile learning, 4.7% (3 participants) neither agree nor disagree, that they find it is easy to get their study material using mobile learning, another 1.6% of the population strongly disagree that they find it is easy to get study material using mobile learning. Lastly, 37.5% of the population strongly agree that they find it is easy to access study material using mobile learning. See Table 4.14.

Table 4.14: I think it is easy to get study materials using m-learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.6	1.6	1.6
	Disagree	1	1.6	1.6	3.1
	Neither Agree nor Disagree	3	4.7	4.7	7.8
	Agree	24	37.5	37.5	45.3
	Strongly Agree	35	54.7	54.7	100.0
	Total	64	100.0	100.0	

c) I think that interacting with mobile learning is clear and understandable.

Regarding interacting with mobile learning, 42.2% of the population (24 participants) agree that they find interacting with mobile learning is both clear and understandable. 17.2% (11 participants) neither agree nor disagree that they find interacting with mobile learning is clear and understandable, 35.9% (23 participants) strongly agree, 3.1% (2 participants) and 1.6% (1 participants) strongly disagree and disagree respectively, that they find interacting with mobile learning is clear and understandable. See Table 4.15.

Table 4.15: I think interacting with m-learning is clear and understandable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	3.1	3.1
	Disagree	1	1.6	1.6	4.7
	Neither Agree nor Disagree	11	17.2	17.2	21.9
	Agree	27	42.2	42.2	64.1
	Strongly Agree	23	35.9	35.9	100.0
	Total	64	100.0	100.0	

d) I think that it is possible to use mobile learning without expert help.

30 (46.9%) out of 64 participants agree that they find that it is possible to use mobile learning without expert help, 12 (18.8%) participants neither agree nor disagree that they it easy to use mobile learning without the assistance of an expert. However, 1.6% and 7.8% of the participants strongly disagree and disagree respectively that they find it easy to use mobile learning without the help of an expert. Lastly, 25% of the participants strongly agree that they find it easy to use mobile learning without any help. See Table 4.16.

Table 4.16: I think it is possible to use m-learning without expert help

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.6	1.6	1.6
	Disagree	5	7.8	7.8	9.4
	Neither Agree nor Disagree	12	18.8	18.8	28.1
	Agree	30	46.9	46.9	75.0
	Strongly Agree	16	25.0	25.0	100.0
	Total	64	100.0	100.0	

(iii) Attitude

a) I have positive feelings toward mobile learning services in general.

59.4% of the participants agree that they have positive feelings toward mobile learning services, 1.6% disagree and strongly disagree respectively that they have positive feelings toward mobile learning services in general, 26% strongly agree that they have a positive attitude toward mobile learning services and 10.9% neither agree nor disagree that they feel positively about mobile learning services. See Table 4.17.

Table 4.17: I have positive feelings toward m-learning services in general

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.6	1.6	1.6
	Disagree	1	1.6	1.6	3.1
	Neither Agree nor Disagree	7	10.9	10.9	14.1
	Agree	38	59.4	59.4	73.4
	Strongly Agree	17	26.6	26.6	100.0
	Total	64	100.0	100.0	

b) It is a good idea to use mobile learning services.

Depicted in Table 4.18 are different views of participants regarding the use of mobile learning services. A large number of participants amounting to 54.7% of the population agree that they think that it is a good idea to use mobile learning services. 5% of the population neither agree nor disagree that the use of mobile learning is a good idea, 32.8% feel very strongly that it is a good idea to use mobile learning services. Lastly 1.6% of the population strongly disagree that they find the use of mobile learning services to be a good idea and 3.1% also disagree that using mobile learning services is a good idea. See Table 4.18.

Table 4.18: It is a good idea to use m-learning services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.6	1.6	1.6
	Disagree	2	3.1	3.1	4.7
	Neither Agree nor Disagree	5	7.8	7.8	12.5
	Agree	35	54.7	54.7	67.2
	Strongly Agree	21	32.8	32.8	100.0
	Total	64	100.0	100.0	

c) I think it is desirable to use mobile learning as opposed to traditional learning.

20.3% of the population neither agree nor disagree that they find the use of mobile learning to be more desirable than traditional learning, 3.1% strongly disagree that the use of mobile learning is more desirable than traditional learning. However, 46.9% agree that they find that it is more desirable to use mobile learning as opposed to traditional learning, and 25% feel quite strongly that they find that the use of mobile learning is indeed more desirable as opposed to traditional learning. Lastly, 4.7% of the population disagree that the use of mobile learning is more desirable as opposed to traditional learning. See Table 4.19.

Table 4.19: I think it is desirable to use m-learning as opposed to traditional learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	3.1	3.1
	Disagree	3	4.7	4.7	7.8
	Neither Agree nor Disagree	13	20.3	20.3	28.1
	Agree	30	46.9	46.9	75.0
	Strongly Agree	16	25.0	25.0	100.0
	Total	64	100.0	100.0	

(iv) Perceived mobility

a) Mobility makes it possible to acquire up-to-date study material.

A sizeable number of the population (67.2%) agree that they find that perceived mobility makes it possible to acquire up-to-date study material, 3.1% strongly disagree and another 3.1% disagree that they find that perceived mobility makes it possible to access latest study material. 21.9% of the population strongly agree that they find that perceived mobility make is possible to access the latest study material and 4.7% neither agree nor disagree that they find that perceived mobility makes it possible to acquire up-to-date learning material. See Table 4.20.

Table 4.20: Perceived mobility makes it possible to acquire up-to-date study material

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly	2	3.1	3.1	3.1
	Disagree	2	3.1	3.1	6.3
	Neither Agree not Disagree	3	4.7	4.7	10.9
	Agree	43	67.2	67.2	78.1
	Strongly Agree	14	21.9	21.9	100.0
	Total	64	100.0	100.0	

b) It is convenient to use mobile learning services anytime and anywhere.

Participants expressed different views regarding the convenience of using mobile learning services anytime and anywhere. 4.7% strongly disagree and the other 4.7% disagree that they find it convenient to use mobile learning services anytime and anywhere. 3.1%, on the other hand, neither agree nor disagree that they find it convenient to use mobile learning services anytime and anywhere. However, a large number of the participants expressed that they feel very strongly about the convenience of mobile learning, this number amounted to 41 participants (64.1%) and 23.4% agree that they find it convenient to use mobile learning anytime and anywhere. See Table 4.21.

Table 4.21: It is convenient to use m-learning services anytime and anywhere

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	4.7	4.7	4.7
	Disagree	3	4.7	4.7	9.4
	Neither Agree nor Disagree	2	3.1	3.1	12.5
	Agree	15	23.4	23.4	35.9
	Strongly Agree	41	64.1	64.1	100.0
	Total	64	100.0	100.0	

c) Perceived mobility is an outstanding advantage when using mobile learning services.

9.4% of the population neither agree nor disagree that they find that computer self-efficacy is and outstanding advantage when using mobile learning services, 3.1% strongly disagree that perceived mobility is an advantage when using mobile learning services, 1.6% also disagree. However, 50% of the population strongly agree that they find that perceived mobility is an outstanding advantage when using mobile learning services, 35.9% also agree that the ability to use the computer makes for and outstanding advantage when utilising mobile learning services (Table 4.22)

Table 4.22: Perceived mobility is an outstanding advantage when using m-learning services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	3.1	3.1
	Disagree	1	1.6	1.6	4.7
	Neither Agree nor Disagree	6	9.4	9.4	14.1
	Agree	23	35.9	35.9	50.0
	Strongly Agree	32	50.0	50.0	100.0
	Total	64	100.0	100.0	

(v) Service & system quality

a). Mobile devices with mobile learning services provide more services in line with the purpose of the system

Table 4.23 shows that 15.6% of the population neither agree nor disagree that mobile devices with mobile learning services provide more services in line with the purpose of the system, 3.1% strongly disagree that mobile devices with mobile learning services provide more services in line with the purpose of the system, the other 3.1% disagree. 51.6% of the population agree that mobile devices with mobile learning services provide more services in line with the system and 20.3% strongly agree that such devices provide services that are in line with the system.

Table 4.23: Mobile devices with m-learning services provide more services in line with the purpose of the system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	3.1	3.1	3.1
	Disagree	1	3.1	12.5	15.6
	Neither Agree nor Disagree	10	15.6	12.5	28.1
	Agree	36	51.6	51.6	79.7
	Strongly Agree	16	20.3	20.3	100.0
	Total	64	100.0	100.0	

b). I have not had any limitations or problems with using mobile learning services

Regarding limitations with mobile learning, 51.6% of the population agree that they have not have any limitations with using mobile learning services, 20.3% strongly agree that they have not had any problems with using mobile learning service. 12.5% neither agree nor disagree and the other 12.5% of the population disagree that they have had any limitations with using mobile learning service and 3.1% strongly disagree. See Table 4.24.

Table 4.24: I have not had any limitations or problems with using m-learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	3.1	3.1
	Disagree	8	12.5	12.5	15.6
	Neither Agree nor Disagree	8	12.5	12.5	28.1
	Agree	33	51.6	51.6	79.7
	Strongly Agree	13	20.3	20.3	100.0
	Total	64	100.0	100.0	

c). Mobile devices with mobile learning services fully meet my academic needs

14.1% of the population neither agree nor disagree that mobile devices with mobile learning services fully meet their academic needs, 4.7% strongly disagree and the other 4.7% disagree that mobile devices that offer mobile learning services fully meet their academic needs. 53.1%, however, agree and 23.4% strongly agree that they find that mobile devices that offer mobile learning services fully meet their academic needs. See Table 4.25.

Table 4.25: Mobile devices with m-learning services fully meet my academic needs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	4.7	4.7	4.7
	Disagree	3	4.7	4.7	9.4
	Neither Agree nor Disagree	9	14.1	14.1	23.4
	Agree	34	53.1	53.1	76.6
	Strongly Agree	15	23.4	23.4	100.0
	Total	64	100.0	100.0	

(vi). Perceived connectedness

a). I feel like I am connected to external reality because I can search for desired study information.

34 (53.1%) participants agree that they feel connected to external reality because they can search for desired study content, 34.4% feel strongly that they feel connected to external reality because they can search for study material that they desire, 9.4% neither agree nor disagree that they feel connected to external reality because they can search for desired study information, 1.6% strongly disagree and the other 1.6% disagree that they feel connected to external reality because they can search for desired study information. See Table 4.26.

Table 4.26: I feel like I am connected to the external reality because I can search for desired study information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.6	1.6	1.6
	Disagree	1	1.6	1.6	3.1
	Neither Agree nor Disagree	6	9.4	9.4	12.5
	Agree	34	53.1	53.1	65.6
	Strongly Agree	22	34.4	34.4	100.0
	Total	64	100.0	100.0	

b) I feel good because I can access the study materials anytime via mobile devices

6.2% of the population neither agree nor disagree that they feel good because they can access study materials anytime via mobile devices, 3.1% strongly disagree that being able to access their study materials anytime via mobile devices makes them feel good. However, a large portion of the population had positive views, 40.6% agree and 48.4% strongly agree respectively that they feel good because they can access their study materials anytime via mobile devices. See Table 4.27.

Table 4.27: I feel good because I can access the study materials anytime via mobile devices

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	1.6	1.6
	Disagree	1	1.5	1.6	3.1
	Neither Agree nor Disagree	4	6.2	9.4	12.5
	Agree	26	40.6	53.1	65.6
	Strongly Agree	31	48.4	34.4	100.0
	Total	64	100.0	100.0	

c). I feel emotionally comforted because I can do my assessments with m-learning at my convenience

Table 4.28 shows that 43.8% of the population agree that they feel emotionally comforted because they can do their assessments with mobile learning at their convenience, 10.9% neither agree nor disagree that they feel comforted because they can do their assessments with mobile learning at their convenience, 3.1 % however strongly disagree that they feel comforted because they can do their assessments with mobile learning at their convenience and 40.6 % strongly agree that they feel comforted that because they are able to do their assessments with mobile learning at their convenience.

Table 4.28: I feel emotionally comforted because I can do my assessments with m-learning at my convenience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.1	3.2	3.2
	Neither disagree nor Agree	7	10.9	11.1	14.3
	Agree	28	43.8	44.4	58.7
	Strongly Agree	26	40.6	41.3	100.0
	Total	63	98.4	100.0	
Missing	System	1	1.6		
Total		64	100.0		

(vii) Intention to adopt

a). I intend to use mobile learning services as much as possible

Table 4.29 presents the views of the participants with regard to their intentions to use mobile learning services. 28.1% of the population strongly agree that they intend to use mobile learning services as much as possible and 64.1% agree that they intend to use mobile learning services as much as possible. However, a few of the participants had negative feelings toward using mobile learning services, 6.3% strongly disagree that they have any intentions to use mobile learning services as much as possible and 1.6% disagree that they intend to use mobile learning services as much as possible.

Table 4.29: I intend to use m-learning services as much as possible

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	4	6.3	6.3	6.3
	Disagree	1	1.6	1.6	7.8
	Agree	41	64.1	64.1	71.9
	Strongly Agree	18	28.1	28.1	100.0
	Total	64	100.0	100.0	

b). I will continue to use mobile learning services if I have access to the service

51.6% of the population feel very strongly about their intention to continue to use mobile learning services as they strongly agree that they intend to continue to use mobile learning services for as long as the service is accessible to them. 39.1% also agree that they will continue to use mobile learning services if they have access to the service. A low number of participants however expressed that they have no intentions to continue using mobile learning services, 3.1% neither agree nor disagree, 1.6% strongly disagree and another 3.1% disagree. See Table 4.30.

Table 4.30: I will continue to use m-learning services if I have access to the service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.6	1.6	1.6
	Disagree	2	3.1	3.2	4.8
	Neither Agree nor Disagree	2	3.1	3.2	7.9
	Agree	25	39.1	39.7	47.6
	Strongly Agree	33	51.6	52.4	100.0
	Total	63	98.4	100.0	
Missing	System	1	1.6		
Total		64	100.0		

c). I will recommend others to use mobile learning.

Table 4.31 presents the views of participants regarding how likely they will recommend mobile learning to other users. 54.7% strongly agree that they will recommend the use of mobile learning to others, 37.5% agree and 3.2% had no intention to recommend others to use mobile learning (1.6% strongly disagree and 1.6% disagree) and 4.7% neither agree nor disagree.

Table 4.31: I will recommend others to use m-learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.6	1.6	1.6
	Disagree	1	1.6	1.6	1.6
	Neither Agree nor Disagree	3	4.7	4.7	7.8
	Agree	24	37.5	37.5	45.3
	Strongly Agree	35	54.7	54.7	100.0
	Total	64	100.0	100.0	

4.6. RELATIONSHIP BETWEEN VARIABLES

To evaluate the proposed mobile learning framework, as set out in Chapter 1, and establish whether there is any relationship between the technology adoption factors, Pearson correlation was conducted. Findings presented in Table 4.32 show that there was indeed a significant and positive correlation between all seven factors for adoption of mobile learning at a UoT in South Africa. The factors are perceived usefulness, perceived ease of use, attitude toward, perceived mobility, service and system quality, intention to adopt mobile learning and perceived connectedness of mobile learning with the correlation coefficients ranging from moderate (r=0.561) to very strong (r=0.783).

Table 4.32: Correlation coefficients

		PU	PEOU	ATT	PM	SSQ	IA	PC
PU	Pearson Correlation	1	.561**	.645**	.741**	.634**	.783**	.754**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	64	64	64	64	64	64	64
PEOU	Pearson Correlation	.561**	1	.511**	.528**	.653**	.520**	.573**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	64	64	64	64	64	64	64
ATT	Pearson Correlation	.645**	.511**	1	.672**	.555**	.622**	.601**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	64	64	64	64	64	64	64
PM	Pearson Correlation	.741**	.528**	.672**	1	.731**	.714**	.744**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	64	64	64	64	64	64	64
SSQ	Pearson Correlation	.634**	.653**	.555**	.731**	1	.501**	.657**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	64	64	64	64	64	64	64
IA	Pearson Correlation	.783**	.520**	.622**	.714**	.501**	1	.716**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	64	64	64	64	64	64	64
PC	Pearson Correlation	.754**	.573**	.601**	.744**	.657**	.716**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	64	64	64	64	64	64	64

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

The relationship between the factors adopted from TAM3 and ETAM is supported by data provided in Figure 4.1. Findings presented are consistent with the preceding finding in Park and Kim's (2014) study in predicting users' intention through the perceived usefulness, perceived connectedness, service and system quality and perceived ease of use. As shown in Figure 4.1, all the relationships between ATT ($r=.622^{**}$, $p<0.01$), PEOU ($r=.520^{**}$, $p<0.01$) and IA were positive and statistically moderately correlated.

In addition, the findings showed that the relationships between PU ($r=.645^{**}$, $p<0.01$), PC ($r=.601^{**}$, $p<0.01$), SSQ ($r=.555^{**}$, $p<0.01$) and ATT were positive and statistically moderately correlated. The relationships between PEOU ($r=.561^{**}$, $p<0.01$) and PU were

found to be positive and statistically moderately correlated. Findings further revealed the relationship between PEOU (r=.528**, p<0.01) and PM was positive and statistically moderately correlated, while the relationship between PM (r=.741**, p<0.01) and PU and the relationship between PC (r=.744**, p<0.01) and PM, were positive and statistically strongly correlated. The relationship between SSQ (r=.731**, p<0.01) and PM was found to be positive and statistically strongly correlated.

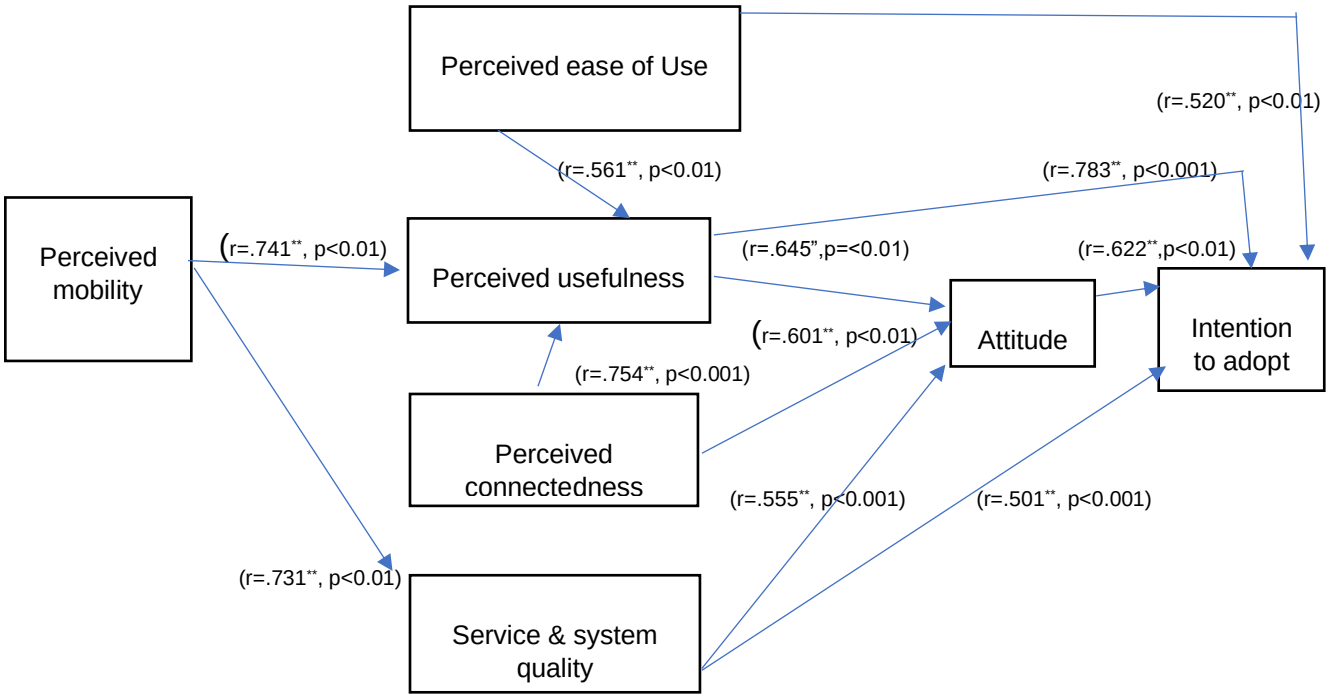

Figure 4.1: Correlation coefficients

4.8. MULTIPLE LINEAR REGRESSION RESULTS

The purpose of this study is to explore factors that affect the successful adoption of mobile learning at UoTs. Consistent with previous researchers, multiple linear regression was conducted on the proposed model variables to determine whether independent variables correlate with those that are dependent. To evaluate the proposed research model, correlation analysis was conducted and the significance of path coefficient (β) and the

squared R (R^2) coefficient of determination were considered as depicted in tables 4.33a to 4.33h.

The results depicted in Table 4.33a show that perceived ease of use of mobile learning with a path coefficient of β=.293, p<0.001 and attitude toward mobile learning with a path coefficient of β=.499, p<0.001 are significant predictors and have a positive influence on the intention to adopt mobile learning. Having compared the standardised coefficients, attitude toward mobile learning was found to have a higher impact on the intention to adopt mobile learning than perceived ease of use (β=.482 ATT vs. β=.274 PEOU). These variables explained R^2=0.445 coefficient of determination on attitude toward mobile learning. The results were consistent with a study done Khairi and Baridwan (2015).

Table 4.33a: Regression results between PEOU, ATT and IA

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.075	.477		2.255	.028
	PEOU	.293	.119	.274	2.459	.017
	ATT	.499	.115	.482	4.328	.000

a. Dependent Variable: IA

The findings presented in Table 4.33b reveal that perceived usefulness of mobile learning with a path coefficient of β=.370, p<0.001 and service and system quality of mobile learning with a path coefficient of β=.175, p<0.001 have a positive influence on attitude toward mobile learning. The results also showed that only perceived usefulness of mobile learning and service and system quality of mobile learning quality are significant predictors on attitude toward mobile learning. It was further revealed that perceived usefulness on mobile learning has a higher impact than service and system quality; this was concluded after the evaluation of the standardised coefficients (β=.383 vs β=.188). Perceived connectedness with a path coefficient of β=.197, p<0.001 was also found to have a positive influence on attitude toward mobile learning. Additionally, these variables explained R^2=0.465 coefficient of determination on attitude toward mobile learning. The findings were consistent with a previous study by Park and Kim (2014)

Table 4.33b: Regression results between PU, SSQ, PC and ATT

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	.999	.437		2.285	.026
	SSQ	.175	.122	.188	1.438	.156
	PC	.197	.160	.189	1.231	.123
	PU	.370	.145	.383	2.562	.013

a. Dependent Variable: ATT

Presented in Table 4.33c are regression analysis results between perceived ease of use of mobile learning, perceived mobility of mobile learning, perceived connectedness of mobile learning and perceived usefulness. The findings revealed that both perceived ease of use of mobile learning with a path coefficient of $\beta=.252$, $p<0.001$, perceived connectedness with a path coefficient of $\beta=.430$, $p<0.001$ and perceived mobility on mobile learning with a path coefficient of $\beta=.585$, $p<0.001$ are significant predictors. The evaluation of standardised coefficients ($\beta=.136$ PEOU, $\beta=.373$ PM, $\beta=.398$ PC) further revealed that perceived connectedness has a higher impact on the perceived usefulness of mobile learning. The variables explained $R^2=0.589$ coefficient of determination on the perceived usefulness of mobile learning (Khairi & Baridwan 2015).

Table 4.33c: Regression results between PEOU, PM, PC and PU

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.183	.390		.469	.641
	PEOU	.145	.101	.136	1.440	.015
	PC	.430	.130	.398	3.316	.002
	PM	.354	.110	.373	3.222	.002

a. Dependent Variable: PU

Perceived mobility with a path coefficient of β=.718, p<0.001 as depicted in Table 4.33d, was found to have a significant and positive influence on the service and system quality of mobile learning. This variable explained R^2=0.534 coefficient of determination on the service and system quality of mobile learning.

Table 4.33d: Regression results between PM and SSQ

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.841	.367		2.291	.025
	PM	.718	.085	.731	8.426	.000

a. Dependent Variable: SSQ

Perceived usefulness with a path coefficient of β=.784, p<0.001 as depicted in Table 4.33e, was found to have a significant and positive influence on the intention to adopt mobile learning. This variable explained R^2=0.613 coefficient of determination on the intention to adopt mobile learning.

Table 4.33e: Regression results between PU and IA

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.076	.329		3.271	.002
	PU	.784	.079	.783	9.920	.000

a. Dependent Variable: IA

Perceived ease of use with a path coefficient of β=.556, p<0.001 as depicted in Table 4.33f, was found to have a significant and positive influence on the intention to adopt mobile learning. This variable explained R^2=0.536 coefficient of determination on the service and system quality of mobile learning.

Table 4.33f: Regression results between PEOU and AI

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.005	.483		4.156	.000
	PEOU	.556	.116	.520	4.792	.000

a. Dependent Variable: IA

Attitude toward mobile learning with a path coefficient of β=.644, p<0.001 as depicted in Table 4.33g, was found to have a significant and positive influence on the intention to adopt mobile learning. This variable explained R^2=0.634 coefficient of determination on the service and system quality of mobile learning.

Table 4.33g: Regression results between ATT and IA

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.690	.422		4.005	.000
	ATT	.644	.103	.622	6.248	.000

a. Dependent Variable: IA

Depicted in Table 4.33h is the regression results between service and system quality of mobile learning and intention to adopt mobile learning. Service and system quality of mobile learning with a path coefficient of β=.484, p<0.001 was found to have a significant and positive influence on the intention to adopt mobile learning. This variable explained R^2=0.554 coefficient of determination on the intention to adopt mobile learning.

Table 4.33h: Regression results between SSQ and IA

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.407	.420		5.737	.000
	SSQ	.484	.106	.501	4.563	.000

a. Dependent Variable: IA

Table 4.34 summarises the model regression results.

Table 4.34: Hypothesis regression results

Criterion	Predictor	Hypothesis	Beta	Sig	Results
Intention to adopt mobile learning	Perceived ease of use	H3	0.293	0.000	Supported
	Attitude	H1	0.499	0.017	Supported
	Perceived usefulness	H5	0.784	0.000	Supported
	Service & system quality	H11	0.484	0.000	Supported
Attitude toward mobile learning	Perceived usefulness	H4	0.370	0.013	Supported
	Perceived connectedness	H9	0.197	0.123	Rejected
	Service & system quality	H10	0.175	0.156	Rejected
Service & system quality	Perceived mobility	H7	0.468	0.000	Supported
Perceived usefulness	Perceived ease of use	H2	0.252	0.015	Supported
	Perceived mobility	H6	0.585	0.002	Supported

	Perceived connectedness	H8	0.430	0.002	Supported
Significant level at p <.05					

For visibility, the multiple linear regression results have been put on the proposed research model as depicted in Figure 4.2.

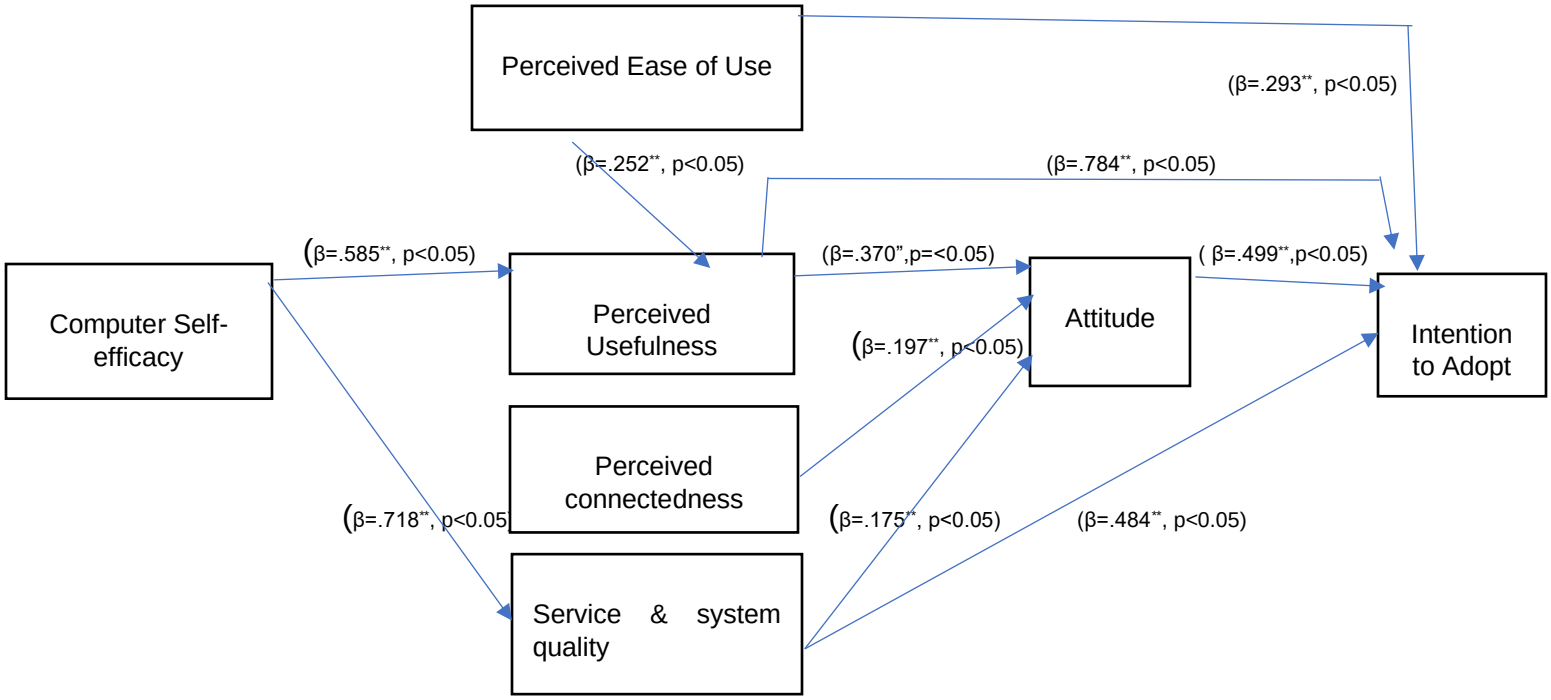

Figure 4.2: Research model regression results

4.9. FINAL RESEARCH MODEL

Based on the research findings discussed in this chapter, Figure 4.3 represents the final research model that could be used by UoTs to adopt mobile learning.

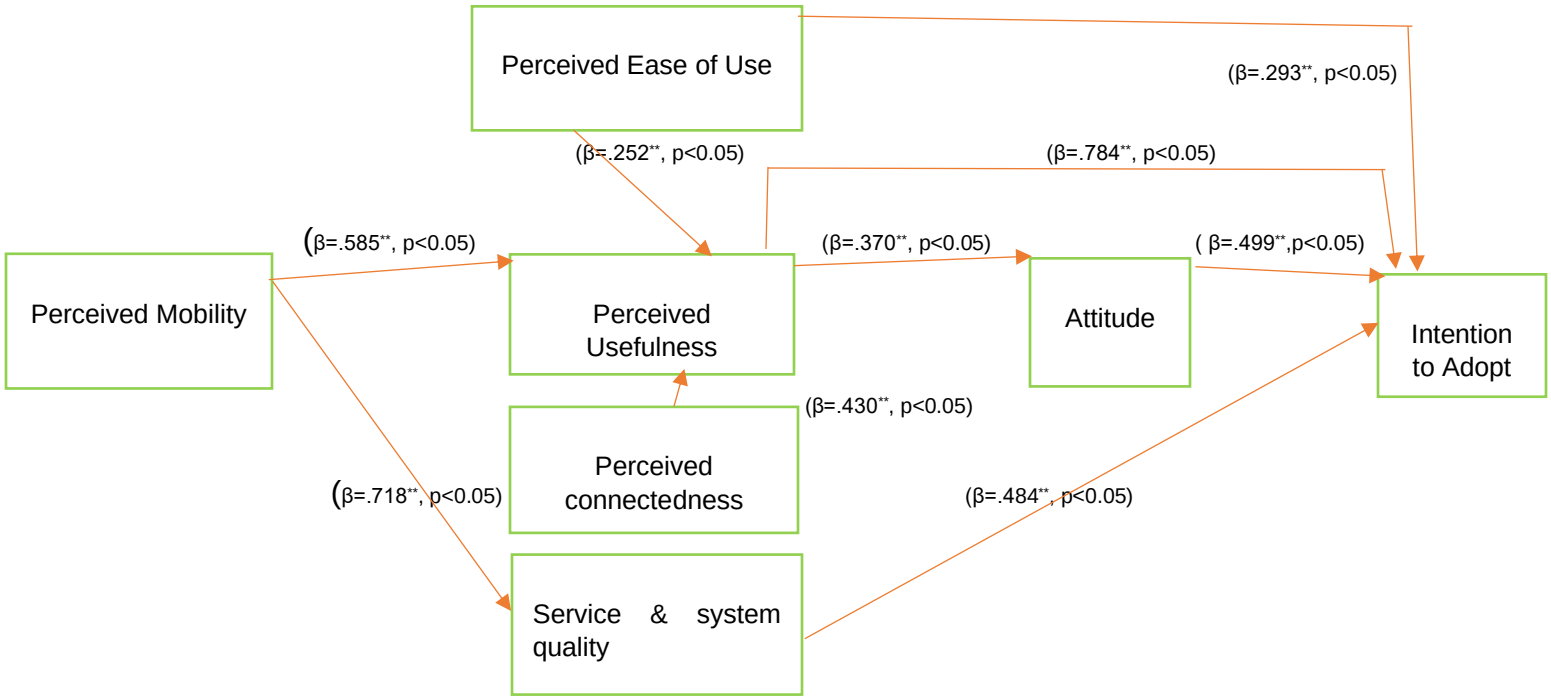

Figure 4.3: Final research model

4.9. CONCLUSION

This chapter presented and analysed the gathered data and discussed the statistical results of the study. 85.9% of the participants were black students between 18-25 years of age, with the level of study ranging from first year to postgraduate. The study employed multiple linear regression analysis to measure the association amongst dependent and independent constructs.

To establish the relationship between mobile learning variables and the intention to adopt mobile learning, Pearson's correlation analysis was conducted, and the findings revealed that there was a correlation between variables. Furthermore, the degree of path coefficient between variables were conducted to determine, which factors influence the perceived ease of use of mobile learning, attitude toward mobile learning and intention to adopt mobile learning. The results show the link between various factors. Lastly, the final research model was highlighted.

CHAPTER 5: DISCUSSIONS AND RECOMMENDATIONS

5.1. INTRODUCTION

The previous chapter presented the results of the study. Such results were then discussed in detail. The significance of the study in the context of mobile learning adoption was examined. This chapter presents the study conclusions, as well as the recommendations drawn from the study and possible ways for future research are mentioned.

5.2. DISCUSSIONS

The superseding purpose of this study was to investigate the adoption of mobile learning at a UoT in South Africa. To accomplish the study objectives and answer the research questions, the study employed the research model derived from ETAM and TAM3. The study was conducted in South Africa and was limited to one UoT located in Gauteng province. The participants of the study were students enrolled in the ICT department. Participants were of various age groups and different levels of study. The findings from the study led to various conclusions related to the three research questions drawn by the researcher.

Research Question 1: What is the effective framework for the adoption mobile learning at UoTs?

In the literature review, technology adoption models were reviewed, and it was found that studies conducted by various researchers provided models and variables that have a significant and positive relationship to the adoption of mobile learning. Studies conducted by various researchers (Park & Kim 2014; Lorenzo-Romero *et al.* 2014; Han & Han, 2014; Martin *et al.* 2013; Al-alak & Alnawas, 2011; Chin & Lin, 2016; Nyeko & Ogenmungu, 2017b) showed that variables such as perceived connectedness, perceived mobility,

perceived usefulness, perceived ease of use and service and system quality have a higher influence on the intention to adopt a particular technology.

Having reviewed technology adoption models, mobile learning adoption model was then proposed. The proposed mobile learning adoption model was derived from ETAM and TAM3.

Research Question 2: To what extent do the mobile learning adoption factors correlate with each other?

The results indicated that there was a strong positive correlation between perceived mobility of mobile learning and perceived usefulness of mobile learning. Likewise, there was a strong correlation between perceived usefulness of mobile learning and intention to adopt mobile learning. Additionally, there was a strong positive correlation between service and system quality and intention to adopt mobile learning. In addition, there was a strong positive correlation between attitude toward mobile learning and intention to adopt mobile learning.

Research Question 3: To what extent do the mobile learning adoption factors have influence on each other?

The factors of the proposed research model were tested using linear multiple regression analysis. The results revealed that perceived usefulness of mobile learning, attitude toward mobile learning, service and system quality as well as perceived ease of use combined are significant predictors of intention to mobile learning. Perceived mobility on mobile learning strongly influences perceived usefulness, more than perceived ease of use of mobile learning. The findings statistically explain that our proposed research model, as in previous research on the adoption of novel mobile technology (Jen-Hung et al. 2007), effectively confirms valid links between the key psychological aspects of the services (perceived connectedness, service and system quality and perceived mobility) and the variables from the original TAM model (attitude, perceived ease of use, perceived

usefulness and intention to use), thereby expanding adoption theories on mobile technology.

In addition, perceived mobility and perceived connectedness were found to be strong influential factors of service and system quality and perceived usefulness, which substantially affected user attitude and ultimately their intention to use mobile learning services. In agreement with preceding studies that showed the positive effects of service and system quality and perceived usefulness on attitudes toward mobile technology (Shin and Shin, 2011, Park and Pobil, 2012), this research confirmed the factors that influence the adoption of mobile learning services.

5.3. RECOMMENDATIONS

While the findings of this study provide significant understanding on adoption of mobile learning services, there are quite a few issues that should be taken into consideration in future research on related topics. Social influences of the participants were not examined in this study. In their UTAUT, Venkatesh et al. (2003) social influences such as subjective norms, performance and effort expectancy and voluntariness have considerable influence on user attitude toward and intention to use a specific technology. The study was limited to one UoT in South Africa, users from traditional universities and TVET colleges are likely to have social experiences that may reveal different adoption patterns. Future studies may consider investigating the adoption levels of mobile learning services.

The findings in this research attained through the Pearson correlations analysis, variables are determined for their individual association with each other; future studies may consider conducting multivariate analysis to assess the interaction between these variables and how they jointly influence the intention to adopt mobile learning.

REFERENCES

ABRAHAO, R.D.S., MORIGUCHI, S., NAOMI & ANDRADE, D.F. 2016. Intention of adoption of mobile payment: an analysis in the light of the unified theory of acceptance and use of technology (UTAUT). *RAI Revista de Administracaoe Inovacao,* 13:221-230.

ABU-AL-AISH, A. & LOVE, S. 2013. Factors Influencing students' acceptance of M-learning: an investigation in higher education. *The International Review of Research in Open and Distributed Learning,* 14:83-107.

ADETOBA, B.T., AWODELE, O. & O.KUYORO, S. 2016. E-learning security issues and challenges: a review. *Journal of Scientific Research and Studies* 3:96-100.

AHLAN, A.R. & AHMAD, B.I.E. 2015. An overview of patient acceptance of health information technology in developing countries: a review and conceptual model. *International Journal of Information Systems and Project Management,* 3:29-48.

AHMAD, N. N., TARMIDI, M., RAIDZWA, I. U., HAMID, M. A. & RONI, M. A. (2014) The application of unified theory of acceptance and use of technology (UTAUT) for predicting the usage of e-zakat online system. *International Journal of Science and Research (IJSR),* 3**,** 63-66.

AILA, F. & OMBOK, B. (2015) Validating Measures in Business Research: Practical Implications. *International Journal of Science and Engineering,* 1**,** 11-19.

AJZEN, I. (1991) The theory of planned behavior. *Organizational Behavior and Human Decision Processes,* 50**,** 179-211.

AKHAVAN, P., HOSSEINI, S. M., ABBASI, M. & MANTEGHI, M. (2015) Knowledge-sharing determinants, behaviors, and innovative work behaviors: An integrated theoretical view and empirical examination. *Aslib Journal of Information Management,* 67**,** 562-591.

AKKOYUNLU, B. & SOYLU, M. Y. (2008) A Study of Student's Perceptions in a Blended Learning Environment Based on Different Learning Styles. *Journal of Educational Technology & Society,* 11**,** 183-193.

AL-ALAK, B. A. & ALNAWAS, I. A. M. (2011) Measuring the acceptance and adoption of e-learning by academic staff. *Knowledge Management & E-Learning: An International Journal (KM&EL),* 3**,** 201-221.

ALRASHEEDI, M. & CAPRETZ, L. F. (2015a). Determination of Critical Success Factors Affecting Mobile Learning: A Meta-Analysis Approach *TOJET: The Turkish Online Journal of Educational Technology,* 14**,** 41-51.

ALRASHEEDI, M. & CAPRETZ, L. F. (2015b). An empirical study of critical success factors of mobile learning platform from the perspective of instructors. P*rocedia - Social and Behavioral Sciences,* 176**,** 211-219.

ALSAIARI, H., PAPADAKI, M., DOWLAND, P. S. & FURNELL, S. M. (2014) Alternative Graphical Authentication for Online Banking Environments. *Human Aspects of Information Security & Assurance (HAISA 2014),* 122-136.

ALSAMYDAI, M. J. (2014) Adaptation of the Technology Acceptance Model (TAM) to the Use of Mobile Banking Services. *International Review of Management and Business Research* 3**,** 2016-2028.

ALWAN, H. A. & AL-ZU'BI, A. I. (2016) Determinants of Internet Banking Adoption among Customers of Commercial Banks: An Empirical Study in the Jordanian Banking Sector. *International Journal of Business and Management,* 11**,** 95-104.

ANA-MARIA BLIUC, P. G., ROBERT A. ELLIS (2007) Research focus and methodological choices in studies into students' experiences of blended learning in higher education. *Internet and Higher Education,* 10**,** 231-244.

ANDREWS, T., SMYTH, R., TYNAN, B. & BERRIMAN, A., VALE, D. & CLADINE, R. (2010) Mobile technologies and rich media: Expanding tertiary education opportunities in developing countries *In: A. G. ABDEL-WAHAB, A., A. EL-MASRY, ed. Mobile*

Information Communication Technologies Adoption in Developing Countries: Effects and Implication., 2010 New York. 1-14

ANGHELACHE, C. & SACALA, C. (2016) Multiple linear regression used to analyse the correlation between GDP and some variables. *Romanian Statistical Review - Supplement* nr. 9 **,** 94-99.

ANTWI, S. K. & HAMZA, K. (2015) Qualitative and Quantitative Research Paradigms in Business Research: A Philosophical Reflection. *European Journal of Business and Management* 7, 217-225.

ASABERE, N. Y. (2013) Benefits and challenges of mobile learning implementation: Story of developing nations *International Journal of Computer Applications* 73, 23-27.

AUBUSSON, P., SCHUCK, S. & BURDEN, K. (2009) Mobile learning for teacher professional learning: benefits, obstacles and issues. *ALT-J, Research in Learning Technology,* 17**,** 233-247.

BASHEER A. AL-ALAK, I. A. M. A. (2011) Measuring the Acceptance and Adoption of E-Learning by Academic Staff. *Knowledge Management & E-Learning: An International Journal,* 3**,** 201-221.

BASKARAN, S., MAHADI, N., RASID, S. Z. A. & RIZAL, A. M. (2017) A Proposed Framework of Academic Staff Up-Take in Integrating E-Learning in the Education Deliver. *International Journal of Academic Research in Business and Social Sciences,* 7**,** 345-358.

BEISEK, B. (2007) *Research methods: Uses and limitations of questionnaires, interviews, and case studies*, GRIN Publishing, 159.

BIDIN, S. & ZIDEN, A. A. (2013) Adoption and application of mobile learning in the education industry. *Procedia - Social and Behavioral Sciences* 90**,** 720-729.

BYOUNG-CHAN LEE, J.-O. Y. & IN LEE C, (2009) Learners' acceptance of e-learning in South Korea: Theories and results *Computers & Education* 53, 1320-1329.

CALITZ, A. P., CILLIERS, C. B. & GREYLING, J. H. (2006) Undergraduate IT distance education using videoconferencing and Internet technologies information technology based higher education and training. *7th Information Technology Based Higher Education and Training, ITHET, 2006 Ultimo, NSW, Australia*. 381-387.

CHEON, J., LEE, S., CROOKS, S. M. & SONG, J. (2012) An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers & Education,* 59**,** 1054-1064.

CHIN, J. & LIN, S.-C. (2016) A Behavioral Model of Managerial Perspectives Regarding Technology Acceptance in Building Energy Management Systems. *Sustainability,* 8**,** 1-13.

COCHRANE, T. & BATEMAN, R. (2010) Reflection on 3 years of m-learning implementation (2007-2009). *IADIS International Conference Mobile Learning* 2010, 81-188.

CORLETT, D., SHARPLES, M., CHAN, T. & BULL, S. (2004) A mobile learning organiser for university students. Wireless and Mobile Technologies in Education, 2004. *Proceedings. The 2nd IEEE International Workshop on, 2004*, 35-42.

CRESCENTE, M. L. & LEEB, D. (2011) Critical issues of m-learning: design models, adoption processes, and future trends. *Journal of the Chinese Institute of Industrial Engineers* 28**,** 111-123.

CRESWELL, J. W. (2009) Editorial: Mapping the field of mixed methods research. *Journal of Mixed Methods Research,* 3**,** 95-108.

DAI, N. H. P., ANDRÁS, K. & ZOLTÁN, R. (2016) E-Learning Security Risks and Countermeasures. *Emerging Research and Solutions in ICT* 1**,** 17–25.

DAI, Z. (2015) Factors affecting university students' intention to adopt e-learning systems: a case study in jiujiang university. *international Journal of Network and Vitual Organisation,* 15**,** 102-119.

DAVIS, F. D. (1989) Perceived Usefulness, Perceived Ease Of Use, And User Acceptance of Information Technology. *MIS Quarterly,* 13**,** 319.

DAVIS, F. D., BAGOZZI, R. & WARSHAW, P. R. (2006) Extrinsic and Intrinsic Motivation to Use Computers in the Workplace. *Journal of Applied Social Psychology,* 22**,** 1111-1132.

DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. (1989) User acceptance of computer technology: A comparison of two theoretical models. *Management Science,* 35**,** 982-1003.

DEBOIS, S. (2016) 9 Advantages and Disadvantages of Questionnaires. *SurveyAnyplace Blog* [Online]. Available:https://surveyanyplace.com/questionnaire-pros-and-cons/. [Accessed July 10, 2018].

DEGERLI, A., AYTEKIN, C. & DEGERLI, B. (2015) Analyzing information technology status and networked readiness index in context of diffusion of innovations theory *Procedia social and behavioral sciences,* 195**,** 1553-1562.

DENZIN, N.K. & LINCOLN, Y.S. (2002) *The qualitative inquiry reader*. California: Sage Publications*.* 103-110.

DUDOVSKIY, J. (2015) *An ultimate guide to writing a dissertation in business studies: a step-by-step assistance*. E-Book. [Online]. Available at: http://research-methodology.net/about-us/ebook/. Accessed: June 15, 2017.DROST, E. A. (2011) Validity and Reliability in Social Science Research. *Education Research and Perspectives,* 38**,** 105-123.

DRUCKMAN, D. (2005) Doing Reserch: Methods of inquiry for conflict analysis*.* Thousand Oaks, CA, *SAGE Publication*s, 205.

ECONOMIDES, A. A. & NIKOLAOU, N. (2008) Evaluation of Handheld Devices for Mobile Learning. *Internation Journal of Engineering Education,* 24**,** 3-13.

ERASMUS, E., ROTHMANN, S. & EEDEN, C. V. (2015) A structural model of technology acceptance. *SA journal of Industrial psychology.,* 41**,** 1-12.

ERIKSSON, P. & KOVALAINEN, A. (2008) Qualitative Methods in Business Research*,* Thousand Oaks, CA, *SAGE Publication*, 149-160.

FISHBEIN, M. & AJZEN, I. (1975) Belief, attitude, intention and behavior: An introduction to theory and research. *in Contemporary Sociology,* 1975, 53

GIKAS, J. & GRANT, M. M. (2013) Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education,* 19**,** 18-26.

GOGTAY, N. & THATTE, U. (2017) Principles of Correlation Analysis. *Journal of The Association of Physicians of India,* 65**,** 78-81.

GOSWAMI, S. (2017) Are customers ready to use mobile technology for banking transactions? an investigation. *Journal of Internet banking and Commerce,* 22, 1-13.

GREGOR, S. (2006) The nature of theory in information systems. *MIS Quarterly* 30**,** 611-642.

GUPTA, P. & DUBEY, A. (2016) E-Commerce- Study of Privacy, Trust and Security from Consumer's Perspective. *International Journal of Computer Science and Mobile Computing,* 5**,** 224-232.

GURITNO, R. S. & SIRINGORINGO, H. (2013) Perceived Usefulness, Ease of use, and Attitude Towards Online Shopping Usefulness Towards Online Airlines Ticket Purchase. *Social and Behavioral Sciences,* 81**,** 212-216.

HAN, I. & HAN, S. (2014) Adoption of the mobile campus in a cyber university. *The International Review of Research in Open and Distributed Learning,* 15**,** 238-256.

HARDIGAN, P. C., POPOVICI, I. & CARVAJAL, M. J. (2016) Response rate, response time, and economic costs of survey research: A randomized trial of practicing pharmacists. *Research in Social and Administrative Pharmacy,* 12**,** 141-148.

HARMELEN, T. V. & PISTORIUS, C. W. I. (1997) Technology and society at a time of sweeping change. *International Symposium on Technology and Society*, University of Strathclyde, Glascow, UK, 1997, 306.

HASHEMIA, M., AZIZINEZHAD, M., NAJAFIA, V. & NESARI, A. J. 2011. What is Mobile Learning? Challenges and Capabilities. *Social and Behavioral Sciences* 30**,** 2477-2481.

HASSIM, T., STRYDOM, C. & STRYDOM, H. (2013) Resilience in a group of first-year psychosocial science students at the North-West University (Potchefstroom Campus). *WEI International Academic Conference Proceedings 2013 Antalya, Turkey*. 1-7.

HEALE, R. & TWYCROSS, A. 2015. Validity and reliability in quantitative studies *Evidence Based Nursing* 18**,** 66-67.

HEFLIN, H., SHEWMAKER, J. & NGUYEN, J. (2017) Impact of mobile technology on student attitudes, engagement, and learning. *Computers & Education 107***,** 91-99.

HERRINGTON, A. & HERRINGTON, J. (2007) Authentic mobile learning in higher education. *Proceedings of the Australian Association for Research in Education (AARE) International Educational Research Conference* 2007, 1-9.

HOFFMAN, E.S. 2013. Social media and learning environments: Shifting perspectives on the locus of control. [Online]. Available at: *http://ineducation.ca [Accessed July 20, 2018] 2013,* 15.

HSIAO, C.-H., CHANG J.-J. & Tang K.Y. (2016) Exploring the influential factors in continuance usage of mobile social Apps: Satisfaction, habit, and customer value perspectives. *Telematics and Informatics,* 33**,** 342–355.

HWANG, G.-J. & CHANG, H.-F. (2011) A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students. *Computers & Education,* 56**,** 1023-1031.

JAFFER, S., NG'AMBI, D. & CZERNIEWICZ, L. (2007) The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges. *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* 3**,** 131-142.

JEFFREY, D. A. (2015) *Testing the technology acceptance model 3 (TAM3) with the inclusion of change fatique and overload, in the context of faculty from seventh day adventist universities: a revised model.* Doctor of Philosophy Dissertations, Andrews University, 85-90

JEN-HUNG, H., LIN, Y.-R. & CHUANG, S.-T. (2007) Elucidating user behavior of mobile learning A perspective of the extended technology acceptance model. *Electron. Lib,* 25**,** 585-589.

JOHNSON, P. & CLARK, M. (2006) Business and Management Research Methodologies, *SAGE Publications*, 98.

JORDAAN, D. B., LAUBSCHER, D. J. & BLIGNAUT, A. S. (2017) Design of a prototype mobile applicatio to make mathematics educations more realistic. *13th International conference Mobile Learning, BUDAPEST, HUNGARY*. 1-10.

KABIR, S. M. S. (2016) Basic Guidlines for Research An Introductory Approach for All Disciplines, *Book Zone Publication*. 182-200.

KAFILONGO, K. W. M. (2016) *The use of pair-programming to enhance the academic performance of tertiary level software development students.* Baccalaureus Technologiae in Information Technology, Vaal University of Technology, 78.

KETAMO, H. M-Learning for kindergarten's mathematics teaching (2002) *Proceeding of IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE 2002), 2002 Växjö, Sweden*. 167-170.

KHAIRI, M. S. & BARIDWAN, Z. (2015) An Empirrical Study on Organizational Acceptance Accounting Information Systems in Sharia Banking. *The International Journal of Accounting and Business Society,* 23**,** 97-122.

KILLAM, L. (2013) Research Terminology Simplified: Paradigms, Axiology, Ontology, Epistemology and Methodology. *Sudbury, ON: Author*, 2013, 8-10

KOLOG, E. A., SUTINEN, E., VANHALAKKA-RUOHO, M., SUHONEN , J. & ANOHAH, E. (2015) Using unified theory of acceptance and use of technology model to predict students' behavioral intention to adopt and use e-counseling in Ghana. *International journal modern education and computer science,* 7**,** 1-11.

KRUGER, D. & RAMDASS, K. Establishing a quality culture in Higher Education: A South African perspective (2011). *Proceedings of PICMET '11: Technology Management in the Energy Smart World (PICMET), Portland, OR*, 2011, 1-9.

MAFUNA, N. W. (2016) Exploring Lecturers' Acceptance Level of Learning Management System (LMS) at Applying the Extended Technology Acceptance Model (TAM). *Journal of Social Sciences,* 48**,** 63-70.

LEGG, G. & MITCHELL., I. (2016) Online eLearning in Tertiary Education. *7th annual conference of computing and information technology research and education New Zealand (citrenz2016).* Wellington, New Zealand, 2016, 1-15.

LI, S., YAMAGUCHI, S. & Takada J-I. (2018) The Influence of Interactive Learning Materials on Self-Regulated Learning and Learning Satisfaction of Primary School Teachers in Mongolia. *Sustainability***,** 2018, 1-19.

LIGI, B. & RAJA, D. B. W. D. (2017) Mobile Learning in Higher Education. *International Journal of Research - Granthaalayah,* 5**,** 1-6.

LIM, S., SALDANHA, T. J. V., MALLADI, S. & MELVILLE, N. P. (2013) Theories Used in Information Systems Research: Insights from Complex Network Analysis. *Journal of Information Technology Theory and Application,* 14**,** 5-46.

LORENZO-ROMERO, C., ALARCÓN-DEL-AMO, M.-D.-C. & CONSTANTINIDES, E. (2014) Determinants of Use of Social Media Tools in Retailing Sector. *Journal of theoretical and applied electronic commerce research,* 9, 44-55

LOWENTHAL, J. N. (2010) Using mobile learning: Determinates impacting behavioral intention. *The American. Journal of Distance Education,* 24**,** 195-206.

MAFUWANE, B. M. (2011) *The contribution of instructional leadership to learner performance.* PHILOSOPHIAE DOCTOR, University of Pretoria, 89-100.

MAKOE, M. (2010) *Linking Mobile Learning to the Student-Centered Approach* [Online]. Available:https://www.checkpoint-elearning.com/university/interviews/linking mobile-learning-to-the-student-centered-approach [Accessed August 12, 2019].

MARJAN LAAL & LAAL, M. (2012) Collaborative learning: What is it? *Procedia - Social and Behavioral Sciences* 31**,** 491-495.

MARTIN, F., PARKER, M. & ALLRED, B. (2013) A Case Study on the Adoption and Use of Synchronous Virtual Classrooms. *Electronic Journal of E-learning,* 11**,** 124-138.

MARTINS, C., OLIVEIRA, T. & POPOVIC, A. (2014) Understanding the internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International journal of information management*, 34, 1-13

MATIKITI, R., MPINGANJIRA, M. & ROBERTS-LOMBARD, M. (2018) Application of the Technology Acceptance Model and the Technology–Organisation–Environment Model to examine social media marketing use in the South African tourism industry. *South African Journal of Information Management,* 20**,** 1-12.

MAVLETOVA, A. (2013) Data Quality in PC and Mobile Web Surveys. *National Research University Higher School of Economics,* 31**,** 725-743.

MCMILLAN, J. H. & SCHUMACHER, S. (2006) Research in education: evidence-based inquiry*,* Boston, *Pearson Education*.

MING-CHIH, C., SHIH-SHIUNN, C., HUNG-MING, Y. & WEI-GUANG, T. (2016) The key factors influencing internet finances services satisfaction: An empirical study in Taiwan. *American journal of industrial and business management,* 6**,** 748-762.

MIRJAM, D. (2015) Rogers Theory on Diffusion of Innovation - The Most Appropriate Theoretical Model in the Study of Factors Influencing the Integration of Sustainability in Tourism Businesses. *Procedia - Social and Behavioral Sciences* 195**,** 1453-1462.

MOURA, A. & CARVALHO, A. A. (2010) Mobile Learning: Using SMS in Educational Contexts. *In:* N. REYNOLDS, M. & (ED.), T.-S., eds. *IFIP International Conference on Key Competencies in the Knowledge Society KCKS,* 281-291.

MUYINDA, P. B. (2007) MLearning: pedagogical, technical and organisational hypes and realities. *Campus-Wide Information Systems,* 24**,** 97-104.

MYERS, M. D. (2009) Qualitative Research in Business & Management*,* London, *SAGE Publication*,6, 292-296.

MYRESTEN, E. & SETTERHALL, M. (2015) *Theory of Reasoned Action and the role of external factors in organic food purchase*.Masters Thesis, Uppsala University.

NADLIFATIN, R., LIN, S.-C., RACHMANIATI, Y. P., PERSADA, S. F. & RAZIF, M. (2016) A pro-environmental reasoned action model for measuring citizens' intentions regarding ecolabel product usage. *Sustainability,* 8**,** 1165.

NAISMITH, L. & CORLETT, D. (2006) Reflections on Success: A retrospective of the mLearning conference series 2002-2005 *Across generations and cultures.* Banff, Canada, p.2-29.

NG'AMBI, D. (2005) Mobile Dynamic Frequently Asked Questions (DFAQ) for Student and Learning Support. *Mobile Technology: The future of learning in your hands.* Cape Town, 2005, 1-14.

NTSHOE, I. M. (2003) The political economy of access and equitable allocation of resources to higher education. *International Journal of Educational Development,* 23**,** 381-398.

NYAKALA, K. S. (2013) *Evaluation of Quality Management Practices in the Ekurhuleni Public Hospitals.* Master's Degree of Technology. University of Johannesburg, 128-135.

NYEKO, J. S. & OGENMUNGU, C. (2017a) Determinants of Electronic Learning Adoption in Higher Institutions of Learning in Uganda: A Learners' Perspective. *Global Journal of Computer Science and Technology: H Information & Technology,* 17**,** 7-20.

OLIVEIRA, T. & MARTINS, M. F. (2011) Literature Review of Information Technology Adoption Models at Firm Level. *Electronic Journal Information Systems Evaluation,* 14**,** 110-121.

OLIVIER, M. S. (2004) Information technology Research, a practical guide for computer science and informatics, Pretoria, *Van Schaik Publishers*, 50.

OSUBOR, V. O. & CHIEMEKE, S. C. (2015) The impacts of information culture of e-learning innovation adoption in learning institutions in Nigeria. *African journal of computing and ICT,* 8**,** 17-26.

OYE, N. D., IAHAD, N. A. & RAHIM, N. A. (2014) The history of UTAUT model and its impact on ICT acceptance and usage by academics. *Education and information technologies,* 19**,** 251-270.

OZDAMLIA, F. & CAVUS, N. (2011) Basic elements and characteristics of mobile learning *Procedia - Social and Behavioral Sciences* 28**,** 937-942.

PALLANT, J. (2016) SPSS Survival Manual: A step by step guide to data analysis using SPSS. London, UK, *McGraw-Hill Education*, 121-213.

PARK, E. & KI JOON KIM (2013) User acceptance of long-term evolution (LTE) services: an application of extended technology acceptance mode. *Program,* 47**,** 188-205.

PARK, E. & KIM, K. J. (2014) An Integrated Adoption Model of Mobile Cloud Services: Exploration of Key Determinants and Extension of Technology Acceptance Model. *Telematics and Informatics,* 31**,** 376-385.

PARK, E. & POBIL, A. P. D. (2012) Modeling the user acceptance of long-term evolution (LTE) services. *Annals of telecommunications,* 68**,** 5-6.

PARK, Y. (2011) A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. *The International Review of Research in Open and Distributed Learning,* 12**,** 78-102.

PAYTON, J., WEISSBERG, R. P., DURLAK, J. A., DYMNICKI, A. B., TAYLOR, R. D., SCHELLINGER, K. B. & PACHAN, M. (2008) The Positive Impact of Social and Emotional Learning for Kindergarten to Eighth-Grade Students. *Collaborative for Academic, Social, and Emotional Learning (CASEL)***,** 2008, 4-50.

PETHERBRIDGE, D. T. (2007) *A concerns-based approach to the adoption of web-based learning management systems*. Degree of Doctor of Education. North Carolina State University, 80.

PETROVCIC, A., PETRIC, G. & MANFREDA, K. L. (2015) The effect of email invitation elements on response rate in a web survey within an online community. *Computers in Human Behavior,* 56**,** p.320-329.

PUNCH, K. F. (2014) Introduction to Social Research: Quantitative and qualitative approaches, *London*, *sage Publications*, 200.

QUEIRÓS, A., FARIA, D. & ALMEIDA, F. (2017) Strengths and limitations of qualitative and quantitative research methods. *European Journal of Education Studies,* 3**,** 369-387.

RAEISI, F. & BEHBOUDI, M. R. (2016) A study of Unified Theory of Acceptance and the Use of Technology in Iranian Organization: Case study of cement factories. *International Business Management,* 10**,** 1132-1140.

RAWASHDEH, A. (2015) Factors affecting adoption of internet banking in Jordan: Chartered accountant's perspective. *International Journal of Bank Marketing,* 33**,** 510-529.

RINDFUSS, R. R., CHOE, M. K., TSUYA, N. O., BUMPASS, L. L. & TAMAKI, E. (2015) Do low survey response rates bias results? Evidence from Japan. *Demographic Research,* 32**,** 797−828.

ROGERS, E. M. (1983) Diffusion of Innovations*,* New York*, The Free Press*, 164.

ROGERS, E. M. (1995) Diffusion of Innovations: modifications of a model for telecommunications. *Die Diffusion von Innovationen in der Telekommunikation.*: Springer, 1995, 1-10.

ROGERS, E. M. (2010) Diffusion of innovations, *New York*, *Simon and Schuster*, 210-232.

SALMI, J. (2012) The Challenge of Establishing World-Class Universities*,* Washington, DC, *The World Bank*, 50.

SAMARAWICKREMA, G. & STACEY, E. (2007) Adopting Web-Based Learning and Teaching: A case study in higher education. *Distance education,* 28**,** 313-333.

SAUNDERS, M., LEWIS, P. & THORNHILL, A. (2003) Research Methods for Business Students*.* Harlow, UK, *Pearson Education Limited,* 107.

SAUNDERS, M., LEWIS, P. & THORNHILL, A. (2009) Research Methods for Business Students, Harlow, UK, *Pearson Education Limited*, 124.

SCHOOR, W. V. (2012) Facilitating the development of agency in first year students. A Practice Report. *The International Journal of the First Year in Higher Education,* 3**,** 81-86.

SHANTAKUMARI, N. & SAJITH, P. (2014) A Study of Student's Perceptions of Blended Learning in certificate courses of Gulf Medical University. *6th Annual Scientific Meeting of Gulf Medical University, Ajman, United Arab Emirates*, 183-194.

SHARMA, B. (2012) Adjustment and Emotional Maturity among First Year College Students. *Pakistan Journal of Social and Clinical Psychology,* 10**,** 32-37.

SHARMA, B. (2016) A focus on reliability in developmental research through Cronbach's Alpha among medical, dental and paramedical professionals. *Asian Pacif Journal of Helth sciences,* 3**,** 271-278.

SHARMA, R. & MISHRA, R. (2016) A Review of Evolution of Theories and Models of Technology Adoption. *Irish Medical Journal,* 6**,** 17-29.

SHARPLES, M., CHAN, T., RUDMAN, P. & BULL, S. (2004) Evaluation of a Mobile Learning Organiser and Concept Mapping Tools*. MLEARN, 2004,* 1-9.

SHARPLES, M., TAYLOR, J. & VAVOULA, G. (2005) Towards a theory of mobile learning. *In Mobile technology: The future of learning in your hands, mLearn 2005, book of abstracts, 4th world conference on mLearning*, 2005, 56-65.

SHIN, D.-H. (2010) Analysis of online social networks: a cross-national study. *Online Information Review,* 34**,** 473-495.

SHIN, D. D. H. & SHIN, Y.-J. (2011) Why Do People Play Social Network Games? *Computers in Human Behavior,* 27**,** 852-861.

SIMPSON, S. H. (2015) Creating a data analysis plan: what to consider when choosing statistics for a study. *The Canadian Journal of Hospital Pharmacy,* 68**,** 311-317.

SINGH, Y. K. (2006) Fundamentals of research methodology and statistics*,* New Delhi, *New Age International*, 81-98.

SIRAGUSA, L., DIXON, K. C. & DIXON, R. (2007) Designing quality e-learning environments in higher education. *Ascilite Singapor, Singapor*, 923-935.

SLIFE, B. D. & WILLIAMS, R. N. (1995) What's Behind the Research?: Discovering Hidden Assumptions in the Behavioral Sciences. Thousand Oaks, CA: *sage Publication*, 99.

STRYDOM, H., VOS, A. S. D., FOUCHE, C. B. & DELPORT, C. S. L. (2005) *Research at grass roots.* Pretoria, Van Schaik, 45.

SULLIVAN, G. M. & JR, A. R. A. (2013) Analyzing and Interpreting Data From Likert-Type Scales. *Journal of Graduate Medical Education,* 6**,** 541-542.

TAHERDOOST, H. (2016) Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *International Journal of Academic Research in Management,* 5**,** 18-27.

TARHINI, A., ELYAS, T., AKOUR, M. A. & AL-SALTI4, Z. (2016) Technology, Demographic Characteristics and E-Learning Acceptance: A Conceptual Model Based on Extended Technology Acceptance Model. *Higher Education Studies,* 6**,** 72-89.

TROCHIM, W. & DONNELLY, J. P. (2006) *The Research Methods Knowledge Base 2nd Edition*, Atomic Dog, 150.

TSHABALALA, M., NDEYA-NDEREYA, C. & MERWE, T. V. D. (2014) Implementing Blended Learning at a Developing University: Obstacles in the way. *The Electronic Journal of e-Learning,* 12**,** 101-110.

UĞUR, N. G., KOÇ, T. & KOÇ, M. (2016) An analysis of mobile learning acceptance by college students. *Journal of Educational And Instructional Studies in the world,* 6**,** 39-49.

Universities South Africa. (2019) *Universities South Africa* [Online]. Available: https://www.usaf.ac.za/public-universities-in-south-africa/ [Accessed August 21, 2019].

UZUNBOYLUA, H., CAVUS N. & Ercag E (2009) Using mobile learning to increase environmental awareness. *Computers & Education,* 522**,** 381-389.

VALK, J.-H., RASHID, A. T. & ELDER, L. (2010) Using mobile phones to improve educational outcomes: An analysis of evidence from Asia. *The International Review of Research in Open and Distributed Learning,* 11**,** 117-140.

VENKATESH, V., MORRIS, M. G., DAVIS, G. B. & DAVIS, F. D. (2003) User acceptance of information technology: toward a unified view. *MIS Quarterly,* 27**,** 425-478.

VICENTE, A. E. (2013) *Teaching practices for the development of the problem solving skill of gr 9 natural science learners.* MASTER'S IN EDUCATION, North-West University, 56-69.

WALSHMAN, G. (1993) *Interpreting information systems in organizations,* Chichester, NH, *Wiley*, 60-71.

WANG, Y.-S., WU, M.-C. & WANG, H.-Y. (2009) Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British Journal of Educational Technology,* 40**,** 92-118.

WEINREICH, N. K. (1996) A More Perfect Union: Integrating Quantitative and Qualitative Methods in Social Marketing Research. *Social Marketing Quarterly* 3, 1-15.

YASER, A., SLEWA-YOUNAN, S., SMITH, C. A., OLSON, R. E., GUAJARDO, M. G. U. & MOND, J. (2016) Beliefs and knowledge about post-traumatic stress disorder amongst resettled Afghan refugees in Australia. *International Journal of Mental Health Systems,* 10**,** 1-9.

YI, C.-C., LIAO, P.-W., HUANG, C.-F. & HWANG, I.-H. (2009) Acceptance of Mobile Learning: a respecification and validation of information system success. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering,* 3**,** 475-479.

YUNUS, M. (2014) Diffusion of innovation, customer attitudes and intention to use mobile banking. *Information and Knowledge Management,* 4**,** 12-18.

ZIKMUND, W. G., BABIN, B. J., CARR, J. C. & GRIFFIN, M. (2009) Business Research Methods 8th Edition, *Cengage Learning*, 2-17.

APPENDIX A: INTRODUCTION LETTER

Vaal University of Technology

19 June 2019

To whom it may concern

Introduction Letter: Magister Technologiae Research

The purpose of this research is to investigate the adoption of mobile learning at the university of technology in Gauteng province South Africa.

The Vaal University of Technology students are requested to conduct a research study on a topic of their preference which will serve as part of their dissertation needed to complete their Magister Technologiae qualification. The research report studies will be published in Vaal University of Technology internal journal for future students to use as point of reference for topics of similar nature.

The purpose of this mobile learning questionnaire is to explain the users understanding, knowledge towards the adoption of mobile learning and assist with the analysis of the results and later write the conclusion.

We would be grateful for your support in taking your time to complete this mobile learning questionnaire, please bear in mind that any information received will not be used for anything other than academic purpose. Also note that your participation will remain anonymous.

Should you wish to contact me in relation to the questionnaire, I'm reachable on motsotuad@vut.ac.za or cdiahho@gmail.com

Yours Sincerely

Motsotua Confidence Hlatshwayo

APPENDIX B: QUESTIONNAIRE

QUESTIONNAIRE: Adoption of mobile learning at the university of technology in South Africa.

SECTION A: DEMOGRAPHIC INFORMATION

1. What is your gender?

☐Male ☐Female

2. What is your age?

☐18-25 ☐26-35 ☐36-45 ☐Over 46

3. Which ethnic group best describes you?

☐Asian ☐Black ☐White ☐Indian ☐Colored ☐Other

4. What is your current level/year of study?

☐First Year ☐Second Year ☐Third Year ☐Postgraduate

SECTION B: ADOPTION OF MOBILE LEARNING QUESTIONS

Please read each statement and then select your choice by clicking inside the square which best indicates how strongly you agree or disagree with the statement.

Strongly disagree=1

Disagree=2

Neither agree nor disagree =3

Agree=4

Strongly agree=5

PERCEIVED USEFULNESS

I think that using mobile learning improves my learning

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I think that mobile learning is useful in my studies

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

Using mobile learning raises our chances to increase our academic effectiveness and performance

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I think that the benefits of using mobile learning outweighs the disadvantages

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I think that using mobile learning enables us to access a lot of academic information

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

PERCEIVED EASE OF USE

I think that using mobile learning is easy

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I think that it is easy to get our study materials using mobile learning

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I think that interacting with mobile learning is clear and understandable

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I think that it is possible to use mobile learning without expert help

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

ATTITUDE

I have positive feelings toward mobile learning services in general

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

It is a good idea to use mobile learning services

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I think it is desirable to use mobile learning as opposed to traditional learning

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

PERCEIVED MOBILITY

Computer self-efficacy services makes it possible to acquire up-to-date study material

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

It is convenient to use mobile learning services anytime and anywhere

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

Computer self-efficacy is an outstanding advantage of mobile devices offering mobile learning services

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

SERVICE & SYSTEM QUALITY

Mobile devices with mobile learning services provide more services in line with the purpose of the system

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I have not had any limitations or problems with using mobile learning services

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

Mobile devices with mobile learning services fully meet my academic needs

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

INTENTION TO ADOPT

I intend to use mobile learning services as much as possible

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I will continue to use mobile learning services if I have access to the service

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I will recommend others to use mobile learning

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

PERCEIVED CONNECTEDNESS

I feel like I am connected to external reality because I can search for desired study information

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I feel good because I can access the study materials anytime via mobile devices

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐

I feel emotionally comforted because I can do my assessments with m-learning at my convenience

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
☐	☐	☐	☐	☐