School of Information Systems

Mobile Learning Model for the Zimbabwe Higher Education Sector

Lydia Maketo

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number HRE2017-0301

Signature: Lydia Maketo

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- With God nothing is impossible (Luke 1vs 37 NKJV)

- I can do all things through Christ who strengthens me (Philippians 4 vs 13 NKJV)

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Abstract

In developed nations such as Australia, New Zealand, the United States of America (USA) and the United Kingdom (UK), mobile learning (m-learning) is used to support and enhance traditional learning and teaching approaches in tertiary institutions. However, many less developed nations such as Zimbabwe are just beginning to incorporate technology in education. Most research on m-learning has been done in developed countries with little empirical research being conducted in developing countries. Although there are numerous on-going m-learning projects in these countries, few research projects have investigated the feasibility of implementing m-learning in tertiary institutions in emerging economies such as Zimbabwe. M-learning presents an opportunity to improve the quality of education in Zimbabwe.

This study will posit that in developing countries similar to Zimbabwe, to the best of my knowledge, there are no m-learning models that focus on both academic and administrative support for higher education which fully encompass all the key characteristics of m-learning implementation including all aspects that influence m-learning adoption in the Zimbabwean context. This PhD research reveals that available m-learning models are inadequate in that none of them meets all the requirements and needs of m-learning at tertiary level in the Zimbabwean context. This research is intended to develop a comprehensive m-learning model for Zimbabwe tertiary institutions. This model considers the stakeholders, challenges, factors influencing adoption, pedagogy and characteristics of m-learning. The findings from this PhD research will inform recommendations for m-learning in tertiary institutions in Zimbabwe.

A mixed-methods approach was adopted for this research, consisting of three phases of data collection. Based on a review of the literature on m-learning and semi-structured interviews conducted with 52 participants, some undesirable aspects of m-learning emerged as m-learning issues. Three (3) focus group discussions were conducted based on the literature review and the outcomes of the semi-structured interviews. The analysis of students' responses indicated the negative impacts that m-learning may have on pedagogy. Based on the literature review and the outcomes of the focus group

discussions, a survey was distributed to 358 participants. The results indicate that m-learning acceptance is divided among learners, similarly readiness of self-learning is divided amongst the learners.

Analysis of all the responses shows that there are six factors that influence m-learning adoption in Zimbabwe. All stakeholders (library staff, faculty heads, lecturers, IT support staff and students) agree that, in addition to other challenges, there is inadequate infrastructure. A variety of m-learning characteristics emerged from this study, with some undesirable aspects of m-learning also emerging as significant m-learning issues. Hence, it is suggested that the implementation of successful m-learning in Zimbabwe will require (1) improved infrastructure, (2) the introduction of a scheme to give all learners access to an appropriate mobile device, (3) a team of technical staff and designers dedicated to m-learning, (4) the provision of active learning activities through innovative practices via m-learning, (5) the establishment of an independent board responsible for monitoring m-learning. The main research outcome from this study is a model for m-learning in Zimbabwe universities. In addition, this study offers four recommendations on m-learning implementation in Zimbabwe universities.

This study had a number of limitations: (1) It did not include all key stakeholders of m-learning in Zimbabwe such as the government institutions (the ministries of higher education and ICT). (2) The ideal survey sample size of 397 could not be achieved; data was collected from 358 participants, which was 9.8% less than the ideal sample. It was difficult to find participants willing to complete the survey, with most potential participants being preoccupied with making ends meet. Currently Zimbabwe is facing an economic downturn which is elaborated in the Introduction chapter under the section, the case of Zimbabwe. (3) The study did not specify the type of mobile technologies, so the mobile devices included smartphones, tablets, laptops etc. A variety of avenues for future research emerged from this study. Large-scale investigations of m-learning could be carried out by including more universities to obtain a better understanding of all aspects of m-learning. Further studies could investigate the use of social networking platforms popular with Zimbabwe tertiary students as learning spaces. The model could be evaluated to determine its applicability to different stages of learning such as primary or secondary school.

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Chapter 1

1. Introduction

1.1 Introduction

The rapid increase globally in the use of connected mobile devices is redefining how teaching and learning occurs. The portability of mobile technologies offers ubiquitous learning which is a new educational paradigm based on principles of mobility, collaboration, immediate learning, and active participation. Mobile technologies are a driving force behind education (Traxler 2007; Naismith 2004; Sharples 2007; Laurillard 2007; Traxler and Vosloo 2014; Crompton and Burke 2018; Xue 2020). With mobile learning (m-learning) yet to be fully established in Zimbabwe universities, this chapter explains how m-learning will benefit Zimbabwe universities. This study examines the various factors that would lead to the successful adoption and implementation of m-learning in Zimbabwe universities. This study will demonstrate that although several frameworks for m-learning are found in literature none of the ones investigated can be adapted to meet the needs of Zimbabwe students in higher education universities.

This chapter commences by providing some context to m-learning, defining m-learning, and tracing the history of m-learning. This is followed by an overview of m-learning in higher education and the challenges facing its implementation. Then the Zimbabwe context is explained, with a focus on the current integration of Information and Communication Technology (ICT) in the education sector. Also presented in this chapter are the research purpose, research questions and objectives, research significance and research methodology. An outline of the thesis structure concludes this chapter.

1.2 M-learning background

From as early as 2009, mobile device ownership, particularly mobile phones, have outpaced the ownership of desktop computers and laptops (International Telecommunication Union 2009). At the end of 2012, around 6.8 billion people had mobile phone subscriptions globally, representing growth in developing and developed regions (International Telecommunication Union 2013). United Nations Educational, Scientific, and Cultural Organisation (UNESCO), although traditionally involved in ICT in education, turned its attention to the promise of m-learning. This was characterised by a variety of activities which included offering m-learning guidelines to member states and the hosting of international mobile learning weeks to better understand the possibilities and challenges of m-learning (Traxler and Vosloo 2014). The cultural bias of mobile technologies, education systems and m-learning are predominantly of the Global North (Traxler 2018). This can present challenges for developing countries that are pioneering m-learning since such countries may have different education systems and must deal with their own cultural biases. In the 2016 NMC report, Johnson et al. (2016) acknowledge that universities are faced with a challenge in regarding to striking a balance between learners' connected and unconnected lives. A holistic education should be mindful of the different transitions of learners' lives.

As of 2018, over 70% of the world population owned a mobile phone with growth in mobile cellular subscriptions expected to rise in developing countries (International Telecommunication Union 2018, 12). The ubiquity, connectivity and portability of mobile devices has brought about a shift in pedagogical practices. The computing power of mobile devices such as mobile phones has transformed mobile phones from being traditional communication tools to a platform for opportunities and development in different sectors including online shopping, tourism and hospitality, financial services, healthcare and education (Wong, Leung and Law 2018; Malwade et al. 2018; Asongu and Boateng 2018; Kuoppamäki, Taipale and Wilska 2017; Nguyen, Barton and Nguyen 2015; Crompton, Burke and Gregory 2017). It is evident that mobile devices are offering new opportunities in different sectors and, in education, this could have a positive impact on the way that teaching, and learning occur.

In some cases, it is the ubiquity of mobile devices and sophisticated capabilities that has led to the integration of mobile technologies with education. Moreover, the fact that mobile technologies are relatively cheaper than desktop computers or laptops makes mobile technologies attractive as educational tools (Traxler and Kukulska-Julme 2005; International Telecommunication Union 2018; Fatima et al. 2019). The use of mobile technologies in education is non-uniform globally. The incorporation of mobile technologies in teaching and learning occurs in different forms: in some communities it is informal, in others it is more structured, and in other communities it has yet to be tried (Kearney and Maher 2019; Kaliisa, Palmer and Miller 2019; Cochrane and Narayan 2018). Mobile devices, particularly mobile phones, have become pervasive. The increased capabilities of mobile technologies make them ideal learning tools for mobile learners who are using their mobile devices frequently.

1.3 What is m-learning?

There is not yet a single agreed definition of m-learning. The definition of m-learning seems to evolve with time and may continue to evolve as the mobile technologies continue to develop. M-learning has been associated with the use of mobile technologies in teaching and learning (Traxler 2009; Iqbal and Qureshi 2012). Some researchers initially limited m-learning to the accessing of educational resources using mobile technologies. Initially, m-learning definitions were device-driven (Hwang and Tsai 2011; Traxler 2005). However, this has shifted to personal and social-driven definitions which take into consideration the technological affordances of the mobile technologies (Baran 2014; Sharples, Arnedillo Sánchez, et al. 2009). Some researchers have considered the mobility of the learner using mobile technologies (Parsons and MacCallum 2017; Stanton and Ophoff 2013; Swanson 2018). A summary of the definitions of m-learning is presented in Table 1.1. Crompton (2013) defines m-learning as learning that occurs in different contexts, through social and content interactions using personal mobile technologies. This definition, that considers the mobility of both the learners and the devices, and acknowledges that learning occurs across a broad spectrum, will be adopted for this study.

Table 1. 1 Summary of m-learning definitions (prepared by author)

Definitions of M-learning
E-learning: M-learning is a continuation and reaction to perceived inadequacies and limitations of conventional e-learning (Traxler 2009; Wains and Mahmood 2008)
Learner-centred: Any learning that happens when a student is not at a fixed predetermined location, or learning that occurs when a learner takes advantage of learning opportunities offered by mobile technologies (Botha et al. 2012; Joan 2013; Crompton 2013)
Techno centric: Use of mobile technologies to facilitate and support learning (Hwang and Tsai 2011; Hutchison, Beschorner, and Schmidt-Crawford 2012; Iqbal and Bhatti 2016)

1.4 History of mobile learning

Mobile devices continue to evolve with increased computational power. Besides the technical advances that Dieterle and Dede (2006) observed, four complementary social trends that have made it important to study mobile devices are: (1) the proliferation of mobile devices, (2) society's movement toward ubiquitous computing, (3) mobile technologies' facilitation of advanced instructional designs based on context learning, and (4) mobile devices' fostering of media based learning styles. M-learning is driven by pedagogic necessity, technological innovation, funding opportunities and a need to address the inadequacies of e-learning (Kadirire and Guy 2009). A diachronic overview of m-learning, extended from the work of Mike Sharples at the Becta open source seminar (Berry 2006), saw three phases of m-learning: (1) a focus on devices, (2) a focus on learning outside the classroom and (3) a focus on mobility of the learner (Pachler, Bachmair and Cook 2010). Some foundational works on m-learning projects in Europe were traced to the 1980s when handheld devices such as the Microwriter were trialled in a few schools (Kukulska-Hulme et al. 2011). In the US, the history of m-learning can be traced to as early as 2004 (Cobcroft et al. 2006). In Africa, some of the theoretical work on m-learning dates back to 2003 (Brown 2003, 2005). Taiwan is one country that has led the research on m-learning from as early as 2001 (Hwang and Tsai 2011). Similarly, Australia began m-learning research in the early 2000s (Hwang and Tsai 2011). A summary of the history of m-learning is presented in Figure 1. 1.

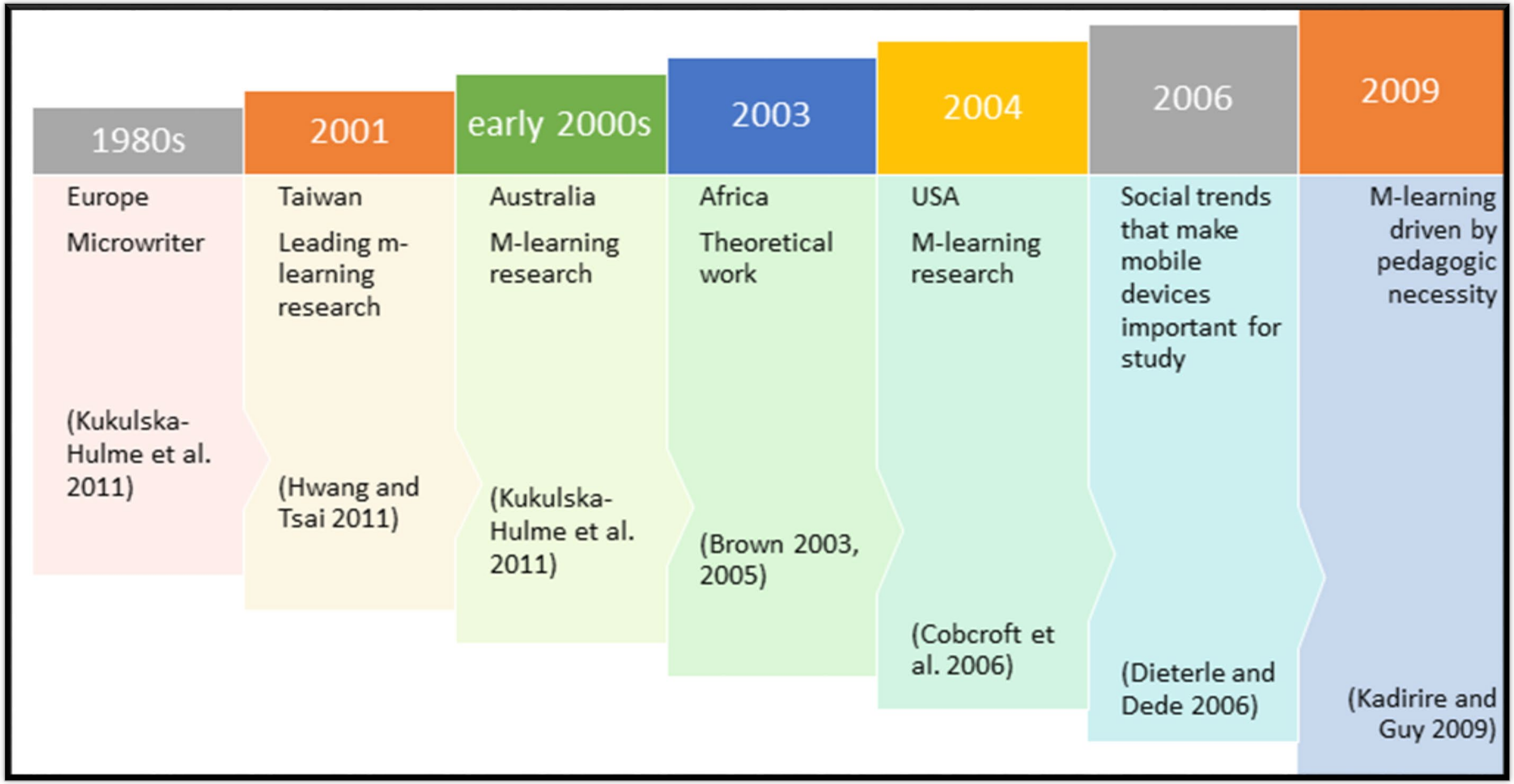


Figure 1. 1 Summary of the history of m-learning (by researcher)

Despite the early start of research globally, the growth and development of m-learning activities, implementation and research has been inconsistent. Several developing countries continually lag behind in m-learning research and implementation. There is current research on m-learning in developing countries that include South Africa, Kenya, India and Latin America but there is a paucity of empirical research in m-learning in tertiary institutions in emerging economies. Research from developing countries has shown positive results for the m-learning projects supporting education in remote locations (Adesope, Olubunmi and McCracken 2007; Barker, Krull and Mallinson 2005; Brown 2005; Ford and Botha 2010; Masters 2005). With most research on m-learning emerging from developed countries, there is a need to increase research in developing countries as well, given that developing and developed countries are significantly different socially, economically, and politically. Hence, the context of the country may be a significant factor in m-learning adoption and implementation.

1.5 M-learning in higher education

Universities worldwide are implementing m-learning in various ways. Section 2.3.4 outlines a variety of ways that m-learning is being implemented in higher education. Numerous m-learning studies have shown positive effects, although there is limited empirical evidence that favours a broad application of m-learning in higher education settings (Pimmer, Mateescu and Gröhbiel 2016; Kaliisa, Palmer and Miller 2019). In a study by Nguyen, Barton, and Nguyen (2015) iPads were found to be an engaging tool for learners; however, these authors also reported the need for more large-scale studies. An effort to acquire a better understanding of m-learning in higher education has been a systematic review by Crompton and Burke (2018). The review analysed 72 studies with less than 40% of the studies emerging from developing countries (Crompton and Burke 2018). It is encouraging that most studies in the higher education settings focus on student achievement. However, more could be explored in terms of the type of pedagogy in m-learning as well as investigating the variables that explain how positive learning outcomes occur with m-learning (Crompton and Burke 2018). In some developing countries, m-learning in higher education is still at the experimental stage, in sharp contrast to developed countries (Kaliisa, Palmer and Miller

2019; Ghasia et al. 2018). There are a few m-learning activities being implemented globally at different levels of learning. Although mobile phones are prevalent in higher education settings, m-learning is not being adopted on a large scale. It may be important to investigate the benefits of m-learning outside the traditional classroom setting since learning also occurs in informal settings.

1.6 Challenges of implementing m-learning in higher education

The large-scale adoption and implementation of m-learning in tertiary institutions can be challenging. Challenges are bound to arise from learners' reluctance to embrace m-learning. Numerous studies to date have been carried out to establish factors that influence students to adopt m-learning (Cheon et al. 2012; Briz-Ponce et al. 2017; Rehman et al. 2016; Hamidi and Jahanshaheefard 2019). Challenges to m-leaning implementation and adoption can also be due to several other factors which will be discussed in section 2.9.

1.7 M-learning opportunities

The potentials of m-learning can be discussed in terms of the technical affordances of the mobile technologies and the m-learning characteristics. The m-learning potentials are examined in section 2.8.

1.8 The case of Zimbabwe

Education is widely accepted as a leading tool in economic development (Brown and Lauder 1996; Gylfason 2001; Pinheiro and Pillay 2016). Although there have been improvements in educational indicators in Zimbabwe, such as increased enrolment across the different levels of education, the quality of education still faces noteworthy challenges. Higher education institutions in Zimbabwe are currently in a series of crises due to a decline in economic growth resulting in under-funding coupled with high student enrolment (Kariwo 2007). Prior to colonisation, the education system was based on a traditional African society. Although not formal, it covered essential aspects of learning (Gelfand 1973). Academic education, unlike industrial education, was perceived to be the means to a better standard of living in Zimbabwe. The Zimbabwe education system is situated in the context of culture, knowledge and power (Mpondi 2004). The integration of technology in Zimbabwe is hindered by: (1) an education system that is examination–theory oriented, and (2) teaching approaches that mainly use the lecture-drill pedagogies (Moyo and Hadebe 2018). It is important to know and understand the factors that may affect the implementation of m-learning in Zimbabwe.

Research on integrating ICT with education in Zimbabwe is slow and sporadic. Chitanana, Makaza, and Madzima (2008), in their assessment of e-learning at universities in Zimbabwe, established that e-learning adoption was slow, and focused on administrative development at the expense of academic outcomes. Chitanana, Makaza, and Madzima (2008) concluded that marginalising the academic aspects disadvantaged learners, leading academics to shun e-learning. Six years later, a change in university lecturers' perceptions of e-learning was observed (Chitanana 2014). The change was attributed to training in instructional technology, which covered e-learning and technology integration. Knowing how to integrate technology in teaching and learning and possibly understanding the benefits of integrating technology in education has brought a shift in the mindsets of the lecturers.

A quantitative study to investigate factors influencing the use of A Learning Management System (LMS), Sakai, revealed that academics were not keen to use Sakai because they lacked the technical know-how (Dube and Scott 2014). Some of the academics had not received the necessary training and some lacked awareness of the LMS (Dube and Scott 2014). Lecturers in Zimbabwe universities have not adopted ICT in their lesson delivery as a result of lack of institutional support, lack of motivation, instructors' failure to perceive benefits for learners, and a general negative attitude towards e-learning (Malufu, Muchemwa and Malufu 2016). Appropriate technical training and information about the benefits of integrating technology in teaching and learning may go a long way to motivating academics to integrate ICT in teaching and learning. It is likely that awareness of the benefits of ICT and the way that the LMS works would improve instructors' attitudes towards the LMS.

Technology adoption in Zimbabwe is under-researched with organisations in education apprehensive about technology adoption (Chiome 2013). Students in Zimbabwe hardly use mobile devices as an educational tool (Kahari 2013). Kabanda (2014a) developed a strategy for sustained quality delivery for distance education programmes to increase enrolments and the adoption of e-learning. The strategy contributes to knowledge on how to increase enrolments but does not detail the processes of how e-learning/m-learning will be adopted. Further research by Kabanda (2014b) on technological affordances and mobile connectivity in Zimbabwe showed that the cost of bandwidth was a major obstacle to the diffusion of mobile technology and e-learning in Zimbabwe.

A quantitative study of lecturers in Zimbabwe concluded that there was need for top management support and a need to align university strategic plans with the implementation of ICT (Mbengo 2014). A study recommending the use of mobile technologies for learners who are physically challenged, and regulation that supports Bring Your Own Device (BYOD) for these learners, highlights how mobile technologies can be a solution for those learners who cannot attend the traditional face-to-face classes (Dube 2015). In their research, Giyane and Buckley (2015) concluded that, in Zimbabwe, cloud computing could help universities access diverse services. However, security and privacy were major barriers to cloud computing adoption in Zimbabwe. A summary of the published research work regarding ICT integration in tertiary institutions is shown in Figure 1.2.

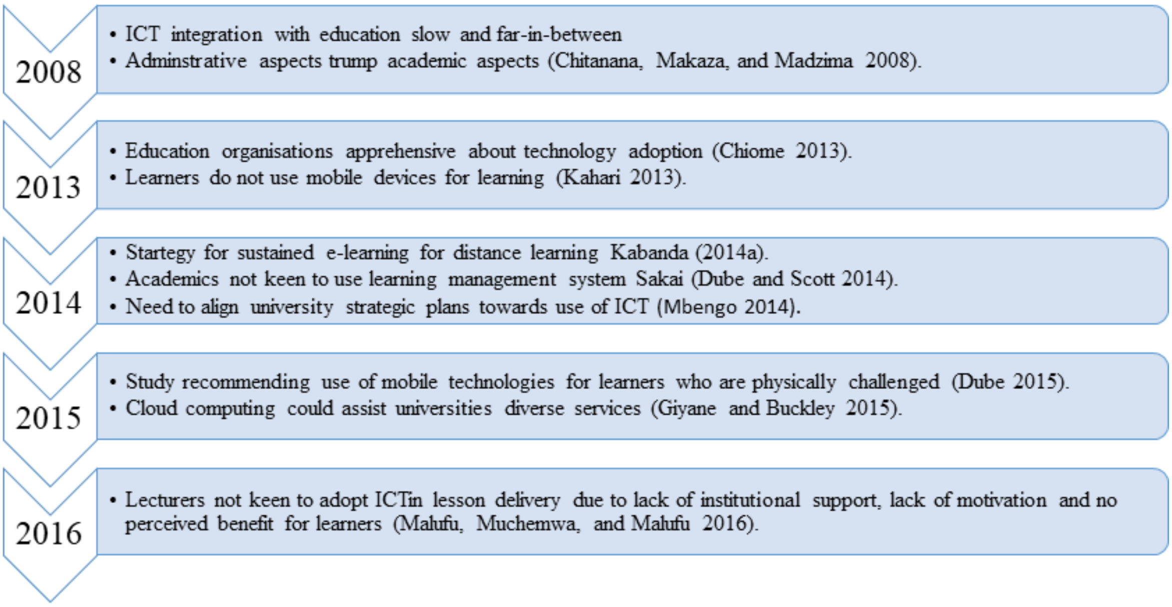


Figure 1. 2 Summary of ICT integration in Zimbabwe tertiary insitutions (by researcher)

In dicussing integration of ICT with education, it is important to point out tht Zimbabwe has been facing an economic downturn. With over a deacd-long economic slide, exponential inflation rates have led to the disintegartion of public health services such as health and education and major shortages of basic commodities (Chigudu 2019). The current economic woes faced by Zimbabwe have led to an increase in poverty incidence (Josephon and Shively 2019). Gukurume (2019) examines challenges faced by university students during a period of unprecedented socio-economic crisis in Zimbabwe. The impact of the socio-economic crisis has impacted data collection for this research as indicated in section 7.5.1.

1.9 Research purpose

The main purpose of this study is to develop a model for m-learning for Zimbabwe universities. Although there is growing interest in m-learning from the education industry, the issues regarding ways to promote the adoption and implementation of m-learning seem to be largely unresolved. For example, the availability of mobile devices for students does not guarantee the use of these devices for educational purposes (Corbeil and Valdes-Corbeil 2007; Maketo and Balakrishna 2015). The acceptance of m-learning by faculty and support staff remains low in some institutions (Alfarani 2014; Freeman 2016; Cruz, Assar and Boughzala 2012). Factors influencing students to adopt m-learning are varied and unknown in developing countries (Sharma, Sarrab and Al-Shihi 2017; Abu-Al-Aish and Love 2013; Al Thunibat, Zin and Sahari 2011). There is a lack of empirical studies in some countries which makes it challenging to implement m-learning (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016; Alsswey and Al-Samarraie 2019; Alkhalifah, de Vries and Rampersad 2017). Zimbabwe is one of the countries that has few empirical studies on m-learning. With the bulk of m-learning projects and research studies emanating from developed countries (Hwang and Tsai 2011; Lamptey and Boateng 2017), existing models from both developed and developing countries cannot be adapted to fit the Zimbabwean context. Implementing m-learning in Zimbabwe, as in most developing countries, is complex as different aspects have to be considered and the reality of Zimbabwe is different from that of other developing countries. Therefore, this study will develop a m-learning model that will align with the needs of universities and their students in Zimbabwe. It is anticipated this model will assist the academics, learning and teaching departments, and the universities' decision makers, to implement m-learning technology in Zimbabwe.

1.10 Research questions and research objectives

To develop suitable models for developing countries, rigorous research is required to understand the various factors that impact m-learning implementation from different stakeholders' perspectives. To determine such factors, there is a need to study and evaluate different stakeholders' perceptions and expectations of m-learning. This leads to the research questions and research objectives set out in Table 1.2. The research questions are discussed in detail in section 3.2.

Table 1. 2 Research questions and research objectives

Research Questions	Research Objectives
What are the factors that influence the implementation of mobile learning in Zimbabwe?	To identify the factors that influence the implementation of mobile learning in Zimbabwe.
What are the stakeholders' personal perspectives and perceptions of the mobile learning model?	To assess stakeholders' perspectives and perceptions of the mobile learning model.
What are students' readiness and acceptance of mobile learning in Zimbabwe?	To investigate student readiness and acceptance of mobile learning in Zimbabwe.
What are the recommendations for mobile learning in tertiary institution in Zimbabwe?	To offer recommendations for mobile learning in tertiary institution in Zimbabwe.

1.11 Research significance

This study contributes to theoretical knowledge about various factors that determine the successful implementation of m-learning in universities generally, and more specifically in relation to the mainstream higher education sector of Zimbabwe. This study shows how each factor in the proposed conceptual model interacts with others, synergistically influencing m-learning implementation.

The study further contributes to practical knowledge by submitting recommendations of m-learning in developing countries. Students, researchers, and academics will be able to use this model as a reference in related future studies. Furthermore, practical significance will be generated from this study as it introduces an m-learning model for tertiary institutions in Zimbabwe, facilitating the integration of technology in their teaching and learning approaches. It is anticipated that the m-learning model will encourage m-learning implementation and adoption in Zimbabwe and will be adopted by other educational institutions in Zimbabwe. The m-learning model will provide guidelines for instructional designers and lecturers when designing m-learning activities and blending these with existing teaching and learning practices. Also, the Zimbabwean government education department, the universities, and various other stakeholders will benefit from this model. Students will be able to experience dynamic learning anywhere anytime.

The recommendations can be utilised by universities and stakeholders in other developing countries planning to implement mobile learning initiatives in their organizations, especially in Africa. The significance of the research is explored in detail in section 7.4.

1.12 Overview of research methodology

The research design adopted for this study is explained in detail in Chapter 3. A mixed-methods approach comprising of qualitative and quantitative research was chosen to ensure the rigour of the study by providing in-depth narratives based on the interviews and focus group discussions which were triangulated with survey responses to increase both the confidence and generalisability of findings. The research strategies employed for this study involved a three-phase approach as shown in Figure 1.3 to gather qualitative data from various stakeholders (except learners) who were interviewed to gather perceptions and opinions on m-learning. This was followed by focus group discussions with learners to gather students' perceptions of and opinions on m-learning. The third phase involved the gathering of quantitative data via an online and paper-based survey of learners.

Figure 1. 3 Three-phase approach research strategies (by researcher)

1.13 Thesis outline

This thesis is organised in seven chapters outlined in Table 1.3.

Table 1. 3 Thesis outline (prepared by researcher)

Chapter	Chapter overview
1	The introductory chapter provides an overview of the study and discusses the structure of the thesis.
2	A comprehensive and critical a review of current research on m-learning in higher education is presented. The chapter points out gaps in literature to justify the research and culminates in the initial proposed model.
3	Describes the research methodology, research design, and procedures for this investigation. The chapter analyses various research approaches and includes a detailed explanation of the chosen mixed-methods approach comprising of a 3-phase approach qualitative interviews, focus group discussions and a quantitative survey. This chapter explains the rationale for the research approach choices made.
4	Presents the data analysis of the interview data gathered from various stakeholders. The data was analysed using thematic analysis in which themes were identified from both literature and the data collected. The chapter presents a written and diagrammatic summaries of the findings. The initial proposed model is refined based on the findings of the interviews.
5	Presents data analysis of the focus group discussions conducted with learners. The thematic analysis was used to analyse the data and the chapter provides both a written and diagrammatic summaries of the results. The model is further refined based on the focus group discussions.
6	Details how the survey data collected from learners was analysed and provides both a written and graphic summaries of the findings. The model is again refined based on the survey findings.
7	This concludes the thesis by presenting a Model for m-learning for Zimbabwe universities. The chapter summarises the research outcomes, research contributions and offers recommendations for m-learning implementation. Research limitations and avenues for future work are also discussed. This is followed by the reference list and appendices.

1.14 Conclusion

This chapter outlined the background to the research topic by providing context of m-learning by looking at ownership of mobile devices and integrating mobile devices with education. The phenomenon of m-learning is introduced and a brief history of m-learning is provided. The chapter gives an overview of how m-learning is being implemented in higher education globally. The chapter highlights challenges of implementing m-learning and points to the potentials of m-learning. The chapter also outlined the case of Zimbabwe giving a brief overview of the education system and integration of ICT with education in Zimbabwe. The chapter defined the research purpose, research questions and research objectives. The chapter outlined the research significance, research methodology for this study and provides the thesis outline. Chapter 2 will give a comprehensive account of the literature review in relation to m-learning in the context of higher education. Based on this review, an initial model for m-learning will be developed. This initial model will form the basis for the development of this thesis and the development of the final model. The final model will be developed after the data collection and analysis, which will address the research questions.

Chapter 2

2. Literature Review

2.1 Introduction

Chapter 1 provided the context of this study by introducing the topic of m-learning in the context of higher learning. The research questions and objectives were formulated, the research design and methodology were described, and the significance of this study was explained. This chapter will provide an overview of the literature on m-learning with a focus on higher education settings. The aim of this chapter is to provide background information on m-learning and to synthesize the literature to highlight the research gaps which will be addressed in this study.

The literature review commences by delineating the scope of the review, then gives the various definitions of m-learning. This is followed by a detailed discussion on theoretical perspectives of m-learning. This section considers how teaching and learning is impacted by the integration of technology. The attitudes and perceptions of lecturers and students, two of the m-learning stakeholders, are discussed at length. The impact on curriculum of integrating mobile technologies, m-learning in particular, is examined. The importance of m-learning in Zimbabwe is considered at length, followed by a discussion of m-learning potentials, challenges, and the negative aspects of m-learning. The review then analyses existing m-learning frameworks, starting with those from developing countries, and followed by m-learning frameworks from developed countries, a summary of various frameworks is presented. The review concludes by discussing the research gap and introduces the initial proposed m-learning model for Zimbabwe tertiary institutions.

2.2 Scope of literature review

This literature review is designed to provide the theoretical background to the m-learning domain. This is done by analysing scholarly contributions guided by the research questions and research objectives. The planning of the literature review was guided by the work of (Randolph 2009; Vom Brocke et al. 2009). The review comprises 371 articles drawn from conference papers, conference proceedings, journals, books and web articles and reports with articles published from 1966 to 2020. Given that m-learning is interdisciplinary, articles reviewed will be related to education and IS and other related domains. Articles used for this review were predominantly from education, pedagogy, technology, a combination of education and technology, information systems and mobile learning. The literature review considers only those articles published in English.

The scope of this literature review draws on the established taxonomy of literature reviews (Cooper 1988). Cooper (1988) suggests that literature reviews can be classified according to six constituent characteristics: focus, goal, perspective, audience, and coverage. The six constituents and their corresponding categories as explained by Cooper (1988) are:

(1) **Focus** of the literature review is concerned with what is of utmost importance to the reviewer. Most reviews will focus on research outcomes, research methods, theories, and applications organisation.

(2) **Goal** includes summarising, criticising, and/or integrating findings.

(3) **Organising** this can follow a historical, conceptual, or methodological structure.

(4) **Perspective** of the review reflects whether a certain position is espoused or not.

(5) **Audience** determines the writing style of the author

(6) **Coverage** has four distinct categories exhaustive (including the entirety of literature on a topic or most of it), exhaustive with selective citation (considering relevant sources but describing only a sample), representative (including only a sample that typifies larger group of articles) and central (reviewing the literature pivotal to a topic).

The application of Cooper's taxonomy for this study is given in Figure 2. 1 and highlights categories that characterise the literature review for this study.

	Characteristic	Categories			
1.	Focus	Research outcomes	Research methods	Theories	Applications
2.	Goal	Integration	Criticism		Central issues
3.	Organisation	Historical	Conceptual		methodological
4.	Perspective	Neutral representation		Espousal position	
5.	audience	Specialised scholars	General scholars	Practitioners/politicians	General public
6.	coverage	Exhaustive	Exhaustive & selective	Representative	Central/pivotal

Figure 2. 1 Taxonomy of literature review [following Cooper (1988)] (prepared by researcher)

This literature review: (1) will focus on all four categories which are research outcomes, research methods, theories, and applications; (2) integrates the findings in articles reviewed with an emphasis on the central issues that impact m-learning adoption and implementation; (3) adopts a conceptual structure by covering key themes; (4) given that m-learning is in its infancy in Zimbabwe and this study aims to develop a framework that is suitable for the Zimbabwean context, the perspective is neither neutral or an espousal position but rather critically considers the various aspects of m-learning prior to the development of the model; and then develop the model; (5) will be of value to various scholars, the IS community at large and m-learning stakeholders; (6) will analyse high-quality articles relevant to the m-learning domain.

2.3 M-learning definitions

There is not yet a consensus on the definition of m-learning from an academic or professional standpoint which could be attributed to the rapidly evolving nature of the field. Literature shows various definitions of m-learning revolving around the ambiguity of the word "mobile" in mobile learning. In the following sections this will be elaborated upon.

2.3.1 E-learning

E-learning has undoubtedly paved the way for m-learning. M-learning is implicitly "mobile e-learning" and the history and development of m-learning have to be understood as both a continuation and reaction to the perceived inadequacies and limitations of "conventional e-learning" (Traxler 2009; Quinn 2000; Zamfiroiu and Sbora 2014). While this suggestion perceives m-learning as an extension of the e-learning initiative accomplished by means of mobile devices, Koszalka and Ntloedibe-Kuswani (2010) argue that m-learning differs from e-learning in that m-learning instruction and support mechanisms are facilitated by mobile technologies intended for learners who are themselves mobile. Koszalka and Ntloedibe-Kuswani (2010) suggest that learners are engaged with other learners and learning resources while outside the confines of a formal classroom. In differentiating between e-learning and m-learning, Parsons, Ryu, and Cranshaw (2006) argue that awareness of both the limitations and benefits of mobile devices means that design requirements for e-learning cannot be simply applied to m-learning. In addition, So (2010), also questioned definitions of m-learning based on e-learning. So (2010) posited that m-learning and e-learning were more likely derivations of distance learning rather than subsets of distance learning, sharing specific traits but also retaining unique characteristics.

Although m-learning may be an e-learning initiative, m-learning goes beyond using mobile devices just to access learning resources. Given the mobility of the learners as well as the use of mobile devices, students can access learning resources while they are in transit. In addition, learners can engage with other learners, thereby increasing student collaboration. While e-learning may have been foundational to m-learning, m-learning has evolved to become something more valuable beyond the using of mobile devices to access learning resources. Suggestions that m-learning is a subset of e-learning suggest the value of m-learning is just in its deployment, focusing on the devices and technologies, and not the access to education that it offers.

2.3.2 Techno-centric

A commonly accepted and earlier definition of m-learning was technology-focused. M-learning is the use of mobile technologies for teaching and learning (Alsaadat 2009; Hwang and Tsai 2011; Kukulska-Hulme 2005; Traxler 2005). Alexander (2004) echoes the same definition and further adds that this form of learning has established the legitimacy of "nomadic" learners. This techno-centric perspective which is pervasive in the literature has been criticised since mobile technologies are constantly undergoing development and the transience and diversity of mobile technology devices renders the techno-centric perspective untenable (Traxler 2009). The earlier definitions emphasised the learning conducted through mobile devices and wireless technologies (Quinn 2000; Traxler 2005). As research in m-learning has continued to evolve and mobile technologies have become more sophisticated, the definition of m-learning has also evolved, with technology no longer being the fulcrum of m-learning.

2.3.3 Learner-centred

Effective learning centres on the learner. There is now a shift from defining m-learning in terms of the mobility of wireless technologies to the mobility of the learners (Botha et al. 2012; Pachler, Bachmair and Cook 2010; Sharples, Arnedillo Sánchez, et al. 2009). M-learning is any learning that happens when the student is not at a fixed, predetermined location, or learning that occurs when the learner takes advantage of learning opportunities offered by mobile technologies (Joan 2013; O'Malley et al. 2005). There is a general consensus that m-learning involves the use of ubiquitous mobile devices in learning and teaching (Iqbal and Bhatti 2016; Naismith 2004; Park 2011). M-learning is a social rather than technical phenomenon associated with mobile people that enables the configuration of spontaneous learning contexts through interactions with people, settings and technology (Vavoula and Sharples 2009). M-learning is concerned with the mobile learner more than the technology since the learner is central to the learning. The learner-centred perspective is a shift from earlier definitions which were technology-focussed. The learner-centred approach emphasizes how mobile learners' benefit from the learning advantages offered by mobile technologies without having to depend on a specific location or time.

2.3.4 Mobility

M-learning involves mobility. This includes mobility of technology, mobility of learners and mobility of learning (Swanson 2018; Li 2018; Parsons and MacCallum 2017; Koukopoulos and Koukopoulos 2017; Stanton and Ophoff 2013; Sharples, Taylor and Vavoula 2007; Hashemi et al. 2011). M-learning also signifies mobility of instructors and mobility of content (Berking, Gallagher and Hagg 2013; Sharples 2007). The mobility of devices, learners, instructors and learning resources changes the way learners access the learning resources, which impacts the learning activities. The various aspects of mobility in m-learning transform how learning and teaching occur, with learning no longer depending on a location and time, coupled with a mobile learner with mobile technologies the context of learning changes.

Given the various approaches to defining m-learning, this study will take a learner-centred perspective of m-learning that considers the different aspects of mobility of m-learning. This approach aligns with (Berking, Gallagher and Hagg 2013; Crompton 2013) who describe m-learning as leveraging mobile devices for knowledge augmentation or acquisition by mobile learners independent of time, location and space. These aspects seem to encompass what m-learning looks like currently.

2.3.5 Mobile learning and higher education

Globally, universities are implementing m-learning in various ways for several purposes. To curb the decline of student enrolment in Science, Technology, Engineering, Mathematics (STEM) and to create a more interactive learning environment at San Francisco State University, tablet PCs and wireless technology have been implemented pre- and post-test to assess learners' performance (Enriquez 2010). The study by Enriquez (2010), addresses effective teaching pedagogy through immediate feedback with benefits perceived to outweigh additional cost for the tablet PC. Another example is the case of the Open University Malaysia SMS initiative. In Malaysia, to be equitable and to democratise education, text messaging was chosen over other mobile technology applications. The SMS initiative is considered to be the first of its kind to be launched on a large scale (over 13000 learners) to make learning more flexible for distance learners, and has been reported to be sustainable in terms of cost, effort and resources (Lim, Fadzil and Mansor 2011). The Malaysian m-learning initiative, while not being the most sophisticated, focuses on inclusivity for all learners, while the San Francisco State University places more focus on effective teaching and learning.

There are several m-learning initiatives that have been carried out globally for medical students. An example is a study in the UK that investigated how mobile technologies enabled learners to learn. In the study, medical students' instant access to information was observed to give learners a better framework for understanding (Davies et al. 2012). Another example is the project in Peru, a developing country, where m-learning was used to cope with the problem of inadequate training opportunities for health workers in urban and peri-urban locations. The distance-learning training program targeted physicians and consisted of clinical modules which simulated interactive clinical cases adapted for mobile devices (Zolfo et al. 2010). In Botswana, a smartphone-based m-learning project was conducted with trainee physicians to improve community health (Chang et al. 2012). The aim was for the physicians to have access to medical information for clinical decision support. The study concluded that m-learning could be used to address medical information needs in resource-constrained environments. The benefits of using m-learning for medical students ranges from improving their understanding to providing training in resource-limited settings. Even within the same subject domain, the need for and utilisation of m-learning may be different but can be tailored to suit the needs of the particular context.

Interest in m-learning has been reported to be increasing in Saudi Arabia. The Saudi government is looking beyond oil reserves as the mainstay of its economy, and is focusing more on IT for Saudi schools and increased funding for mobile learning projects in higher education (Garg 2013). The Qassim College of Medicine claims to be the first m-learning program in Saudi Arabia, (Garg 2013). Interest in m-learning in Saudi Arabia in higher education appears to be driven by the need to create a knowledge-based economy and global economic competition.

The WhatsApp instant messaging application is used in m-learning to access collaboratively generated academic resources. A university in South Africa utilised WhatsApp for previously disadvantaged students to improve student engagement by means of anonymous interactions amongst learners and between learners and instructors (Rambe and Chipunza 2013). In this initiative, the lecturer also used WhatsApp for academic planning and scheduling of tasks including what students needed to prepare for the upcoming lectures. This is another example of the successful application of m-learning in a resource-constrained environment, which addressed the objective of increasing student engagement and meaningful appropriation of educational resources. In another South African university, WhatsApp was successfully used to create dialogic spaces for student collaborative engagements to facilitate research project work outside the classroom (Ngaleka and Uys 2013). In this project, use of WhatsApp alleviated the problem of insufficient computer laboratories as learners could use their mobile phones. It was observed that one advantage of using WhatsApp was that learners could access the history of conversations which was better than always trying to remember things. In this case, similar to the earlier one, m-learning was used to enhance student engagement by circumventing the challenge of expensive ICT hardware and software in disadvantaged institutions.

M-learning can be used to overcome learning challenges. In a Turkish university, m-learning was integrated with a Geographic Information System (GIS) module in a pilot course to overcome challenges of poor application of knowledge in a GIS unit (Erkollar and Oberer 2012). The pilot project meant students worked interactively and it was observed that the application of knowledge improved compared to previous results. A traditional approach to teaching and learning in which the instructor is the major or only source of knowledge can be a limiting factor for learners. M-learning in the GIS pilot project enabled student collaboration and improved student performance.

It is evident that tertiary education institutions are adopting m-learning in various ways to suit their needs. M-learning implementation should take into account the objectives of the project and should be designed to meet these. The different ways and reasons for implementing m-learning as discussed above highlight how m-learning goes beyond the question of integrating mobile technologies with education. Because large-scale m-learning initiatives can be complex and costly, the objectives of the project must be clearly defined, and other factors that could impact the implementation and adoption of m-learning, must be considered.

2.3.6 Application of m-learning

M-learning in higher education ranges from simple applications to support teaching and learning to sophisticated systems. Simple applications include messaging applications which have been broadly categorised into (1) teaching and learning support and (2) communication and administrative support. Messaging applications have been used to successfully support traditional classroom instruction and to help students improve their knowledge of subject matter (So 2016; Brown and Mbati 2015). So (2016) evaluated the effectiveness of WhatsApp messaging in a teacher-training institute in Hong Kong. The results showed that WhatsApp was well-received by learners as a learning support and could help students improve their knowledge and understanding of course material. In India, first-year medical students used WhatsApp to help them prepare for their final Physiology exams (MI and Meerasa 2016). WhatsApp allows users to share documents, and video and audio clips without additional costs if the user has Internet access, which is valuable in providing support for teaching and learning. Essentially, WhatsApp is a communication tool; so, in addition to supporting teaching and learning, due to their portability, mobile technologies can be used for effective communication and administrative support.

More advanced applications such as games have been utilised in teaching and learning. In an effort to develop student interest and motivation to learn Chemistry, a mobile game-based tutorial, Akamia, was developed for secondary school students to provide them with tutorial-type teaching (Ahmad and Rahman 2014). A solution to the difficulty of learning and understanding programming concepts has been found in the development of a mobile application that incorporates a traditional African strategy game. MobileEdu implements a traditional strategy game Ayo, to improve student interaction, motivation and engagement when learning to program (Oyelere, Suhonen and Laine 2017). The gamification of learning makes learning more interactive, which keeps learners engaged. As in any game, the learners must think of their next move which means they simultaneously learn as well as improve problem–solving skills.

M-learning gives access to more academic resources and learning communities, and a different and more flexible way of learning. M-learning offers learning unrestricted by classrooms or set curricula; it enables autonomous learning, flexibility and collaboration (Schuck, Kearney and Burden 2017). Learner autonomy and collaboration are enhanced by making accessible a wide range of resources. The flexibility allows learners to carry out learning tasks when it is most convenient for the learner. M-learning has been used to increase access and equity in higher education. A notable example is that of Kenya's Dayster University which launched Daystar Mobile offering m-learning for higher education on a large-scale (Vateta 2017). A mobile nursing app Jibu, is helping health workers in Kenya, Uganda and Tanzania engage in ongoing training and the app is also used to support student nurses (Becker et al. 2017). The ability to access educational materials via mobile technologies means that learners have a broad range of resources; this promotes both learner independence and habits of lifelong learning.

Some applications on mobile devices are not specifically designed for learning and teaching. However, such applications offer features such as geolocation, digital objects, data access, maps and readers that can be adapted for m-learning (Pandey and Singh 2015). Augmented reality is an example of a sophisticated use of m-learning that bridges the virtual and real worlds and has opened new possibilities for teaching and learning. Augmented Reality (AR) allows digital content to be seamlessly overlaid and integrated into our perceptions of the real world (Yuen, Yaoyuneyong and Johnson 2011). Mobile devices and AR enable ubiquitous, collaborative and situated learning enhanced by games, and model computer simulations and virtual objects in real environments (Broll et al. 2008; Dunleavy, Dede and Mitchell 2009). It is likely that features such as AR which make learning more interactive and engaging are likely to lead to greater retention of knowledge.

There are various ways in which m-learning can be implemented in higher education. In resource-constrained countries such as Zimbabwe, the implementation of m-learning may be one way of addressing issues of expensive ICT infrastructure by circumventing the need for high-technology computer laboratories while still providing access to academic resources. Given the socio-economic challenges Zimbabwe is currently experiencing, there is a need to consider inclusivity and equitable access to higher education. A diagrammatic summary of section 2.3 is shown in Figure 2. 2.

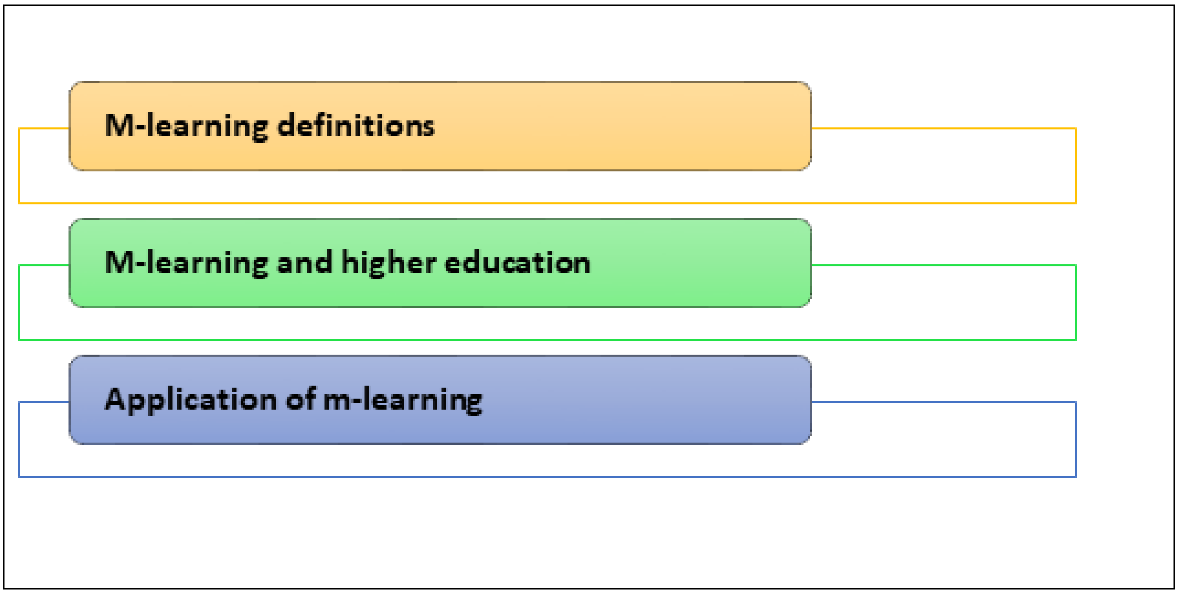


Figure 2. 2 Summary of Section 2.3 (prepared by researcher)

2.4 Theoretical perspectives of mobile learning

Theories of learning arise from multiple disciplines. Learning theories can be described as conceptual frameworks used to comprehend and establish how information is absorbed, processed, and retained during learning (Luis and D'Cunha 2014). Early m-learning research showed a lack of explicit foundation on learning theories (Traxler and Kukulska-Hulme 2005). However, efforts to consolidate the m-learning domain have resulted in more researchers demonstrating how current theories of learning could be used to evaluate the applicability of mobile devices in the educational context. Sharples, Taylor, and Vavoula (2005) reason that for a theory of learning to be of value, it must be based on contemporary accounts of practices that enable successful learning.

2.4.1 Learning theories

Literature shows a wide range of learning theories that can be applied to m-learning activities. These learning theories include behaviourist, cognitivist, constructivist, situated, problem-based, socio-cultural, collaborative, conversational, navigationism, location-based, (Keskin and Metcalf 2011; Naismith 2004; Herrington and Herrington 2007; Parsons and MacCallum 2017), and scaffolded learning (Dekhane 2012). Although there are numerous learning theories, the challenge is how to apply the theories to m-learning. It can be challenging to find studies that have designed m-learning activities based on specific learning theories. It is easier to find studies in which learning theories are mentioned. Learning theories in m-learning studies are either not explicit or not clear about the practical application (Viberg 2013). A theory that specifically targets m-learning is the "Theory of mobile learning" by Sharples, Taylor, and Vavoula (2007). The literature abounds with studies that are concerned with learning theories; however, in most of the works reviewed, the application of the theory is unclear.

2.4.2 Traditional learning theories

The absence of solid learning theories for m-learning led Naismith (2004) to bridge this gap by considering new practices in light of the existing learning theories, namely behaviourist, constructivist, situated, collaborative, informal, and lifelong learning.

2.4.2.1 Behaviourism

The behaviourist learning theory draws on the stimulus-response pattern of conditioned behaviour (Skinner 1968; Chomsky 1959), based on Pavlov's work. Behaviourism has informed teaching and learning. Behaviourism application to m-learning will be explored in this section. In an online learning environment behaviourism involves breaking down the curriculum into smaller manageable instructional steps which learners can repeat (Weegar and Pacis 2012). In the behaviourist learning paradigm, technology-aided learning involves the presentation of a problem (stimulus) followed by the learner's contribution to the solution (response) (Naismith 2004). Activities can include drill and feedback, in-class polling, discussion, question and answer and skills-based learning like language learning (Parsons and MacCallum 2017). Some examples of the application of behaviourist theory to m-learning are: (1) the BBC's initiative to provide revision content on mobile devices (Bitesize 2003); (2) the use of mobile phones and PDAs for language learning (Thornton and Houser 2004) in which Japanese students received mini-lessons; (3) a classroom response system that provides feedback on answers to questions (Wood 2004). There are a variety of ways in which behaviourist theory can be applied to m-learning.

Behavourism has been criticised for not involving students in solving problems through use of direct instructions and assessing students' learning based on responses to questions (Weegar and Pacis 2012). Alshalabi, Hamada, and Elleithy (2013) assert that behaviourism is currently ignored as a serious theoretical base for education and teaching and is often incorrectly associated with a teacher centred model. Early research argued that the behaviourist approach, while popular for learning, was at odds with the potential of mobile technologies to provide more direct ways for learners to engage with content in an authentic context (Naismith 2004). A more recent study has contradicted Naismith's earlier views. Behaviourism applied through game-based learning using Kahoot! proved student concentration to be higher, and increased engagement and motivation. Classrooms were described as dynamic, and students were focused and competitive (Wang and Lieberoth 2016). However, it can be argued that there is still a place for drill and practice in self-regulated or teacher-directed learning. In addition, mobile applications can be used for classroom management which would be related to behaviourism.

2.4.2.2 Constructivism

Constructivism is an active process whereby learners construct new ideas based on both current and past knowledge (Bruner 1966). Under constructivism theory, knowledge is constructed by the individual from within rather than transmitted by an outside source (Vygotsky 1980). Vygotsky (1980) emphasises the importance of interaction with others in building knowledge, as well the use of tools such as language and computer to mediate knowledge construction. Constructivism is learner-centric and allows learners to control the pace of their learning and aligns with the characteristics of m-learning (Reychav and Wu 2015; Peng et al. 2009; Al Hamdani 2014). Compelling examples of the implementation of constructivism principles with mobile technologies are found in participatory simulations (Naismith 2004), with earlier examples including the Virus game (Colella, Borovoy and Resnick 1998) and Savannah (Facer et al. 2004). Several other activities have since emerged based on the application of constructivism in m-learning.

Constructivism theory falls under a continuum that is divided into three broad categories: cognitive constructivism, social constructivism and radical constructivism (Doolittle and Camp 1999; Boghossian 2006). This study will focus on social-constructivism. Social-constructivism emphasises on the collaborative nature of learning. Social-constructivism theory perceives knowledge as being constructed with interpersonal social interactions which are critical for the construction of knowledge (Andrews 2012). There are a variety of ways by which constructivism can support m-learning. These include areas such as language learning (Al Hamdani 2014), and mobile game-based learning (mGBL) (Giannakas et al. 2018). Game-based learning is centred on the learner, and promotes social-constructivism by encouraging collaboration (Bressler, Oltman and Vallera 2018). Some examples of studies underpinned by constructivism have yielded positive results including greater enthusiasm shown by learners and instructors, increased engagement with learners, and learner enjoyment (Ahmad and Rahman 2014; Al Hamdani 2014; Cochrane 2010; Swanson 2018). These examples are shown in Table 2.1.

Table 2. 1 Examples of m-learning activities supported by constructivism (developed by researcher)

Author(s) & Year	**Type of study**	**Country**	**Participants**	**Activity of m-learning**	**Results**
(Cochrane 2010)	Case study	New Zealand	Bachelor of Product design students	Use of video recordings to capture reflections, discussions, and brainstorming sessions.	Project was enthusiastically adopted Lecturers reported increased engagement with students.
(Al Hamdani 2014)	Case study	Oman	40 English teachers	Learning activities such as translating texts, check spelling.	Successful implementation of mobile devices based on constructivist approach.
(Ahmad and Rahman 2014)	Field study	Malaysia	40 high school Science students	Akamia Chemistry Mobile-game based tutorial.	Students were satisfied with the game
(MacCallum and Parsons 2017)	Online Mobile toolkit	New Zealand	15 Staff from Higher education	Online mobile toolkit	Feedback shows that the tool helps educators think more clearly on relationship between learning theory and m-learning activities.
(Swanson 2018)	Case study	United States	15 first-year college students	Assessment tool to facilitate reviews on instructor's perceived pedagogical validity for m-learning	Students were able to employ scientific methodology to gather data and research in the moment which support constructionist approaches

Mobile technologies in the hands of mobile learners offer a variety of ways of constructing knowledge. Instructors can offer information and learning materials to current learners who are always on the move and have access to mobile technologies. By having platforms that extend discussions and collaboration among learners, learners are likely to construct knowledge beyond the classroom. Individual learners, through their interaction and collaboration with peers, can construct new ideas. This can also be done through game-based learning as learners are invited to solve problems and construct their own meanings.

2.4.2.3 Collaborative

Collaborative learning is dependent on social interactions. The collaborative learning theory is derived from the social constructivist work of (Vygotsky 1980). Vygotsky (1980) claims that in a collaborative learning setting groups work together to construct new knowledge with shared meaning. Mobile technologies' capabilities and their wide context use have a greater proclivity to foster collaboration (Naismith 2004). Collaborative activities in mobile game-based learning environments, in addition to enhancing knowledge acquisition, foster the development of other skills such as self-directed learning, problem solving, peer assessment, and socialising (Giannakas et al. 2018). Although they are numerous advantages to collaborative learning, this learning can be fraught with distractions which can disadvantage the learner (Stanton and Ophoff 2013). There is a suggestion that for collaborative learning to be fruitful, learners should engage in structured interactions based on prescribed rules establishing how groups are formed and how learners collaborate and solve problems (Alvarez, Alarcon and Nussbaum 2011). It is likely that well-structured collaborative activities via m-learning will yield positive results.

Table 2. 2 presents several structured m-learning activities supported by collaborative learning theory. The results from m-learning activities under the collaborative theory, while not fully conclusive, suggest that m-learning can have a positive impact on teaching and learning. It was reported that learners agreed that some of the activities supported information sharing and group discussions (Lan et al. 2012). Kearney, Burden, and Rai (2015) indicate that collaboration in face-to-face contexts was predominant in their study with a need to exploit collaboration opportunities in the networked characteristics of m-

learning. On the other hand learning activities using Schoology were designed to foster collaboration both physically and virtually (Priyatno 2017). The instant students' interactions, interactions between learners and the instructor and the increased motivation, are a welcome contribution to teaching and learning as these can enhance the overall learning experience (MacCallum et al. 2017). Table 2. 2 shows the benefits of collaboration which lead to the sharing of ideas and increased motivation which makes learning more engaging.

Table 2. 2 M-learning activities supported by collaborative learning theory (developed by researcher)

Author	Activity	Results
(Cochrane 2010)	Undergraduate students-involved an assessed online Blog/e-portfolio showcasing students design processes which is part of a collaborative hub with worldwide peers and potential employers	Students saw many benefits (compared to traditional pen and paper journals) even though some reported microblogging was relatively time-intensive.
(Lan et al. 2012)	Problem based learning in a discussion environment	Most students agreed that system supported info sharing and group discussion.
(DeWitt, Siraj and Alias 2014)	Secondary school science –group activity	Group activities well received, others did not like to depend on group members.
(Reychav and Wu 2015)	Field experiment in Geography to increase peer influence through sharing	Not fully conclusive but leaning on positive.
(Kearney, Burden and Rai 2015)	Face-to-face, online and data sharing collaboration	Teachers are cautiously exploring potential of collaboration using m-learning.
(Koukopoulos and Koukopoulos 2017)	Educational platform supported by mobile applications that enables collaborative projects with students able to share private educational content within a group	Students embraced the proposed platform.
(MacCallum et al. 2017)	Case study-user interface design-mobile technologies were used to support student sharing and collaboration Case study-E-business strategies-strong collaborative aspect with local and international audience	Instant interaction amongst learners and between learners and instructor Increased motivation and involvement for learners
(Priyatno 2017)	Use of Schoology m-learning system that offers interactive learning platform for collaboration between instructor and university students in English language learning.	Schoology provided opportunities for collaboration through peer feedback using discussion board, which led to learner autonomy.
(Alioon and Delialioğlu 2019)	Authentic collaborative m-learning activities implemented in an undergraduate Computer networking class.	Students perceived using the mobile tool as proper enhancement of collaboration.

There are numerous ways of applying the collaborative theory to m-learning. Collaboration in m-learning may lead to more autonomous learning as learners collaborate with each other. Learning is therefore not restricted to the actual classroom and collaboration is not restricted to time and place. Because it enables the sharing of materials and discussions with peers, m-learning may help learners to better understand course material. Collaboration with peers may reduce the anxiety of those learners who are not comfortable interacting with the instructor.

2.4.2.4 Situated learning

Situated learning suggests that learning can be enhanced by ensuring it occurs in an authentic context. Situated learning holds that learning is not just the acquisition of knowledge by individuals, but also a process of social participation (Lave, Wenger and Wenger 1991). Various studies on situated learning using mobile technologies have discussed the varied aspects of context regarding situated learning. Context is a mixture of the physical features, constraints of the learning location and the social features of the learning activities based on the activity theory (Wali, Winters and Oliver 2008). Furthermore, Wali, Winters, and Oliver (2008) argue that other definitions of context in m-learning are ambiguous and focus on the utilisation of mobile technology rather than on the learning practices that occur in physical and social contexts. Situated learning is the here-and-now learning (Martin and Ertzberger 2013). Martin and Ertzberger (2013) describe the learning as authentic because of the context-based applications, engaging in new and powerful ways and that learning takes place naturally without directed effort. Stanton and Ophoff (2013) discuss the m-learning context in terms of:

- Learner’s personal status that includes preferences, learner history and demographic information.
- Situational context brought about by the nomadic and ubiquitous nature of mobile technology which can involve interruptions and distractions and can be unpredictable.
- Learning environment context where the learner can move beyond classroom, taking the classroom while removed from the classroom context, and the m-learning environment create its own environment and engage with the learner.

A summary of different aspects of contexts for m-learning is given in Figure 2.3.

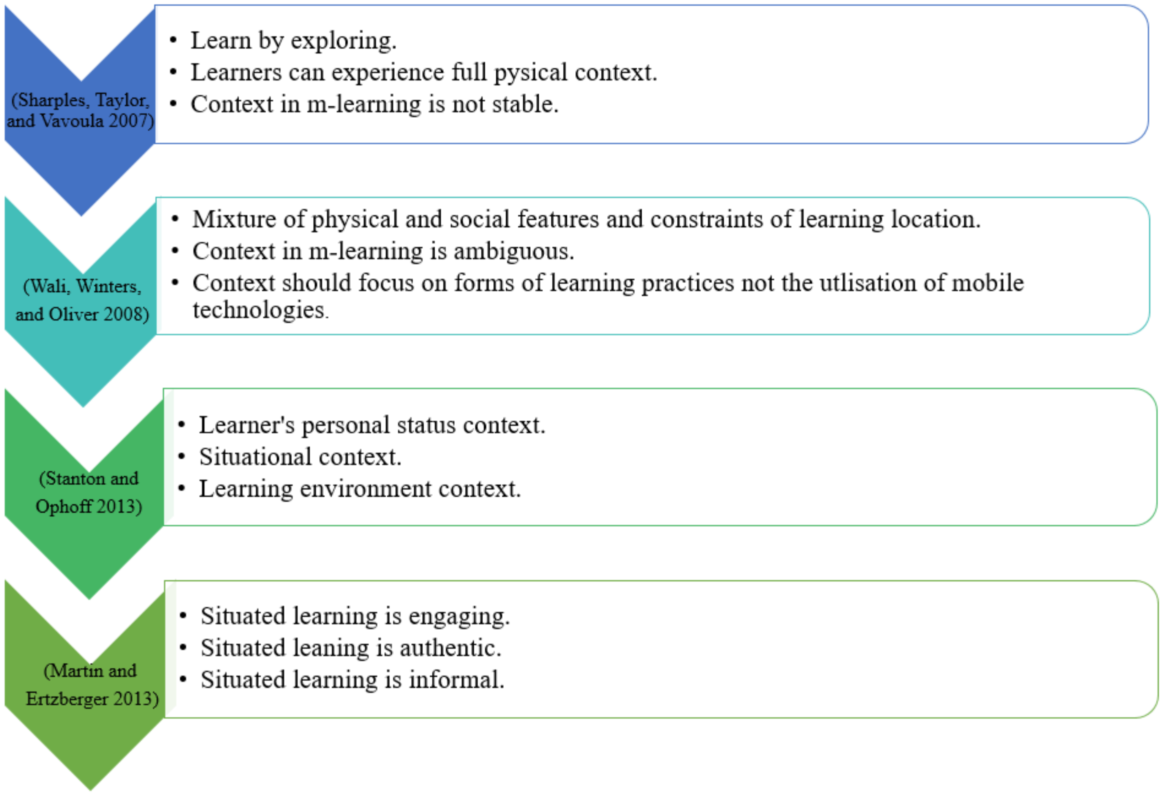


Figure 2. 3 Summary of aspects of context in m-learning (developed by researcher)

Naismith (2004) asserts that the museum and gallery sector have been at the forefront of context-aware learning. Sharples, Taylor, and Vavoula (2007) discuss the use of MOBIlearn by young participants and adults at art galleries, highlighting the challenges associated with both traditional learning and technology. Although the benefits of situated learning have been identified, researchers find few examples of highly contextualised situated authentic m-learning (Kearney et al. 2012). A study involving undergraduate students of instructional design, conducted by Martin and Ertzberger (2013) showed that students enjoyed an authentic learning experience. Opportunities offered by mobile technologies for situated context learning appear to be largely unrealised (Lindsay 2016). A critical review by Giannakas et al. (2018) showed that situated learning underpins the majority of mobile game-based learning. A broader application of situated learning will not only make learning enjoyable, but will likely make it more engaging and will positively transform teaching and learning as more authentic learning occurs. Situated learning can keep learners motivated, thereby improving the teaching and learning environment.

2.4.2.4.1 Personalised learning

M-learning facilitates personalised learning. Personalisation draws on the motivational theory of Pintrich and Schunk (1996) and the socio-cultural theory of Vygotsky (1980). Personalisation is key to m-learning as it includes learner choice, self-regulation and customisation (McLoughlin and Lee 2008). Learners have autonomy over the learning content as well as control over location, pace and time to learn (Kearney et al. 2012). Personalised learning speaks of flexibility in learning. Augmented Reality applications and customised interactions with the Internet of Things (IoT) offer varied ways for learners to choose, manipulate and apply information to suit their needs in a pervasive learning environments (Laine et al. 2009). Personalised learning makes learning flexible as learners have control of their learning.

Personalised learning recognises diversity, individuality and different approaches to learning (Traxler 2007). Learners learn best when they can contextualise what they learn. M-learning facilitates personalised learning since learning occurs at no pre-determined location at any time which allows the learning to be contextualised. Effective learning follows a socio-constructivism approach which is learner-centred, knowledge-centred, assessment-centred and community-centred (Bransford, Brophy and Williams 2000). With m-learning, learning and collaboration are not restricted by place or time which allows learning to be contextualised which may be difficult to achieve in a traditional classroom set-up. Personalised learning under m-learning allows autonomy and ownership of the learning (Kearney et al. 2012). Hence, with m-learning, learners take more responsibility for their learning and experience a more authentic learning environment which can also encourage life-long learning.

2.4.2.5 Informal learning

Informal learning can be described as learning that is unstructured, experiential and non-institutional but is learner-controlled and takes place as people go about their daily activities (Marsick and Volpe 1999; Ferguson et al. 2015). Studies into informal learning date back to 1971 (Tough 1971) with more recent work in 2006. In Canada, it was noted that informal learning was prevalent amongst adults Livingstone (2006). Informal learning is a simple contrast to formal learning (Eraut 2004). Eraut (2004, 240) notes that informal learning:

- Recognises the social significance of learning from other people.
- Is largely invisible because it is either taken for granted or not recognised as learning.
- The resultant knowledge is either tacit or regarded as a person's general capability.

There is not enough empirical evidence of m-learning being applied in informal learning possibly because of (1) the difficulty of capturing the use of mobile technology in the informal context and (2) the lack of common key performance indicators against which to measure progress of the learners (Jones, Scanlon and Clough 2013; Khaddage, Müller and Flintoff 2016) . A review of m-learning trends has shown that across the years informal learning is the most predominant in m-learning studies (Chee et al. 2017). Examples of informal learning include the MyArtSpace project (Sharples et al. 2007) which supported school children's learning activities during a museum visit, and a collaborative inquiry, the Ambient wood project, for school children (Rogers and Price 2008). A study by White and Martin (2014) with older learners involved students using informal mobile practices for mathematics in which students mathematise commonplace objects and events through photographs and videos. Jones, Scanlon, and Clough (2013) conducted several case studies on informal m-learning. The first case study, the Personal Inquiry (PI) project involved over 500 secondary school students and teachers. The project aim was to support and develop personal science inquiries that would be engaging for learners. Students conducted their inquiries in their own time, supported by a software toolkit, nQuire, developed especially for this project. The second case study investigated informal learning in the Geocaching community, the aim of which was to identify learning opportunities arising from interactions between people, location mobile and social technologies. In informal learning, knowledge is constructed through informal discussions, and silent observers who do not participate in discussions are involved in informal learning when they view other participants' contributions (DeWitt, Siraj and Alias 2014). Traditionally, most learning occurred in a structured environment in a pre-determined location. As technology advances and learning is no longer restricted to location and time, this presents an opportunity to keep learners engaged with their learning through both formal and informal means.

2.4.2.6 Lifelong learning

Lifelong learning is the formal and informal learning that takes place throughout people's lives and gives them the knowledge and skills needed to fully participate in society (Laal 2011). There are suggestions that lifelong learning will become the lifeblood of higher education (Becker et al. 2017). The basic premise of lifelong learning is that it is impossible for learning institutions to equip learners with all the knowledge and skills they will need to prosper throughout their lifetimes (Sharples 2000). However, the creation of ubiquitous access to educational materials, coupled with mobile technologies, has the potential to foster learner independence and build habits for lifelong learning (Becker et al. 2017). Lifelong learning recognizes that learning occurs all the time and is influenced by environments and specific situations (Naismith 2004). There is evidence of lifelong learning in the field of medical education in Nepal and nurse education in South Africa (Pimmer 2014; Pimmer et al. 2013). It is not surprising that there may be a lack of specific studies underpinned by lifelong learning theories because of the nature of this type of learning as people may use mobile technologies for ad-hoc searches. Nonetheless, m-learning provides opportunities to independently investigate and learn about things, making learning more comprehensive and thus encouraging learners to pursue lifelong learning.

2.4.2.7 Implications of applying traditional learning theories

Some of the learning theories were developed when most learning took place without technology. These learning theories might not adequately address the current situation where learning can be integrated with technology, resulting in learning that can be stored in technology (Siemens 2004). Early m-learning research was not explicitly founded on learning theories (Traxler and Kukulska-Hulme 2005). There was under-theorisation of m-learning particularly its essence, process and outcomes (Wali, Winters and Oliver 2008; Sharples, Taylor and Vavoula 2005). Learning theories on m-learning should take into account the mobility of learners, the engagement with technology and that learning can occur outside the lecture halls (Sharples, Taylor and Vavoula 2005). It is evident that there are interesting technical opportunities associated with mobile technologies in teaching and learning. However, the use of these technologies should be grounded in firm learning theories (Patten, Sánchez and Tangney 2006; Herrington and Herrington 2007). Laurillard (2009) notes the importance of ensuring that pedagogy exploits and challenges technology and not vice versa, and further suggests that although technology constantly changes and can radically affect teaching and learning, pedagogical principles determine what it takes to learn. Although learning theories are examined discretely, they share certain characteristics in terms of learning activities that operationalise these theories (MacCallum and Parsons 2017). It is imperative that m-learning be grounded by learning theories if teaching and learning activities are to be successful.

The integration of mobile technologies by some tertiary education institutions reflect different theoretical approaches employed. An example is the practice of podcasting lectures, which enables learners to repeatedly listen and have control over the replay (Tynan and Colbran 2006). This type of teaching and learning applies the behaviourist paradigm, where repetition is used as the learning strategy. Similarly, the use of mobile devices by faculty staff to remind students about assignment submissions and course enrolments reflects the theory of practical support through administrative and communication support (So 2016; Yousuf 2007). However, it has been argued that this practical support is useful for guiding and managing the learning rather than for developing and improving higher order thinking (Herrington and Herrington 2007). However, m-learning can be used simultaneously to offer administrative support as well as enhance higher order thinking.

Sharples, Arnedillo-Sánchez, et al. (2009) draw on activity theory positing that knowledge is constructed through activity in a society that is becoming increasingly mobile. Sharples, Arnedillo-Sánchez, et al. (2009) further assert that context is a construct central to m-learning as it is continually created by people in their interactions with other people, with their surroundings, and with everyday tools. This is at odds with traditional teaching, which is founded on the supposition of context stability, where location are common resources are fixed. The learning theories that underpin particular m-learning activities will likely depend on the objective of these activities. An activity designed to offer a “real-world experience” will likely be supported by situated learning, while the practical support theory will cater for communication and administrative activities like assessment requirements and submissions, and assignment reminders.

The mobility of learners and the integration of learning with technology has led to a variety of ways of acquiring knowledge and skills anywhere and anytime. Mobile technologies have influenced the way that knowledge is generated, transmitted, valued, owned and consumed in the society (Traxler 2009). If mobile technology in higher education continues to be used predominantly within a didactic, teacher-centred paradigm, rather than a constructivist environment, these technologies will be essentially be used for content delivery which would be pedagogically regressive (Herrington and Herrington 2007). Educators should move beyond traditional didactic methods and explore alternative pedagogies to meet student needs in the mobile era (Farley et al. 2015). While there are numerous practical reasons for adopting m-learning strategies and technologies in higher education, the theoretical justifications remain important. Even though learning activities and the technology employed become interwoven, pedagogical theories need to drive the teaching and learning process, with the technology facilitating the process. M-learning as a mode of teaching and learning that introduces new variables to the teaching and learning process, such as mobile learners, mobile devices, and learning that is unconstrained by place and time. It is imperative to understand how learners learn with these new variables guided by pedagogical principles.

2.4.3 Non-traditional Learning theories and application to m-learning activities

Traditional learning theories are a subset of various learning theories that show how people learn and develop knowledge. Apart from the six traditional learning theories discussed above, the articles reviewed discuss other learning theories that support m-learning studies.

2.4.3.1 Connectivism

A more recent theory, connectivism, attempts to address some of the shortcomings of the pre-technology learning models. The connectivism model views learning as a process that occurs within ill-defined environments of shifting core elements and is not entirely under the control of the learner (Siemens 2004). Further, connectivism suggests that learning can reside outside individuals within a database or organisation, and is focused on connecting specialised sets of information. (Siemens 2004) also claims that connectivism provides insights into the learning skills and tasks required by learners if they are to excel in the digital era, and that the field of education has been slow in appreciating the impact of new learning tools. Siemens (2004) and Sharples, Taylor, and Vavoula (2005) take into consideration some aspects considered effective in learning by Bransford, Brophy, and Williams (2000) in developing theories of m-learning. Connectivism is a successor to behaviourism, cognitivism and constructivism, these three theories have the following limitations: (1) their intrapersonal view of learning; (2) their failure to address the learning that is located within technology and organizations; and (3) their lack of contribution to the value judgments that need to be made in knowledge-rich environments (Siemens 2004). Downes (2010) explains connectivism as “the thesis that knowledge is distributed across network connections, and therefore learning consists of the ability to construct and traverse networks”.

Questions have been raised as to whether connectivism is a learning theory. Opposing views to those of Siemens (2004) have been discussed at length by Kop and Hill (2008) and Bell (2011), with claims that connectivism should be viewed as a developing perspective or phenomenon. The claim that connectivism replaces its antecedents as a new theory has been challenged (Kerr 2006). Duke, Harper, and Johnston (2013) argue that connectivism might apply to selected areas of knowledge but cannot be universally applied to all subjects, thereby failing as a learning theory. Moreover, Duke, Harper, and Johnston (2013) add that knowledge cannot be derived only from a system that is continually available; rather, the learner needs to internalise concepts and apply these concepts to real-world scenarios. Connectivism does not focus on the learning process of an individual but rather on learning within the dynamics of social interaction, connection and collaboration (McLoughlin and Lee 2008). Traxler (2009, 6) argues that the m-learning community, in looking for a theory, could face with three options and dilemmas:

1. Import theory from 'conventional' e-learning and worry about transferability.
2. Develop theory *ab initio* locally and worry about validity.
3. Subscribe to some much more general and abstract theory and worry about specificity and granularity.

Connectivism is nearer the second option (Traxler 2009), developed as an alternative to social constructivism (Traxler 2010). Connectivism can be a suitable pedagogical approach as some learners are engaging in m-learning or using m-learning to support their learning (Farley et al. 2015). Connectivism anticipates that knowledge for everyone in the community will expand and remain current through connections between fields, ideas and concepts (Bair 2016). MacCallum et al. (2017) demonstrate the application of connectivism through case studies. The case studies investigate the new learning environment where technology can connect and link learners and learning resources within a classroom and within a global community. In an exploratory study on m-learning deployment in Tanzania, the results did not support the connectivism view of the ideal environment of learning in a digital era (Ghasia et al. 2018). The results highlighted how limited infrastructure can prevent learners and instructors from realizing the full potential of the connected sphere, which results in isolated and mundane learning.

The evolving nature of m-learning may suggest that there is not yet sufficient work in m-learning to fully support a learning theory. Connectivism has been less rigorously validated compared to the traditional learning theories of the 20th century. So, the debate on whether or not connectivism is a learning theory may continue for years to come. Undoubtedly, some elements of connectivism theory are applicable and relevant to m-learning. M-learning is a technological response to different learning cultures and methods in a connected world comprising mobile learners.

2.4.3.2 Other non-traditional learning theories applied to m-learning

There are several non-traditional learning theories that have been applied to m-learning. Table 2.3 shows the various authors who have discussed these non-traditional learning theories and how the theories have been applied to m-learning. A majority of the non-traditional learning theories emerge from social sciences; however, two theories shown in Table 2.3 are specifically for m-learning. The two theories are connectivism (section 2.4.3.1) and the theory of mobile learning. These two theories take into consideration learning in the digital era, which is not restricted to physical location or time, and how learning may be subject to a variety of opinions. Elements of these theories are often embedded in m-learning activities. The application of these two theories may in some cases not be explicit, although a closer look at m-learning activities will reveal the application of some aspects of these m-learning theories.

Table 2. 3 Non-traditional learning theories

Theory	Explanation of theory in relation to m-learning	Author(s)	Application in m-learning
Activity theory	The activity theory is a cultural–historical activity system and is mediated by tools that both constrain and support learners in their goals of transforming their knowledge and skills (Wali, Winters and Oliver 2008; Liaw 2010). Activity theory consists of six elements subject, object, tools, community, rules and division of labour (Chung, Hwang and Lai 2019)	(Park 2011; Sharples, Taylor and Vavoula 2007; Cochrane 2010; Zurita 2004; Liaw 2010; Wali, Winters and Oliver 2008; Cowan and Butler 2013)	• Use of PDAs as learning and work place tools Waycott (2004) • Museum Art Gallery exhibit (Scanlon, Jones and Waycott 2005).
Cognitive theory	A cognitive theory of multimedia learning assumes that the human information-processing system includes dual channels for visual/pictorial and auditory/verbal processing. Each channel has a limited capacity for processing information, and	(Laurillard 2009; Reychav and Wu 2015)	• Multimedia (text, video, audio, animation, images) • SMS, MMS, e-Mail, Podcasting • Mobile TV

	active learning allocates appropriate cognitive resources during learning (Reychav and Wu 2015).		• Mobile app linked to AR and Mobile Pedestrian Navigation (Joo-Nagata et al. 2017)
Communities of practice	Mobile technologies offer opportunities of interaction and communication amongst learners, between learners and instructors and members of communities of practice (Brown 2005)	(Parsons and MacCallum 2017; Herrington and Herrington 2007; MacCallum and Parsons 2017; Cochrane 2010)	M-learning project comprised of three universities and three polytechnics that involved (Cochrane and Narayan 2018)
Connectivism	A learning theory of the digital age with characteristics such as: ○ learning and knowledge rest in varying opinions ○ learning may reside in non-human appliances ○ capacity to know more is more critical than what is currently known ○ Maintaining connections is needed to facilitate learning (Siemens 2004)	(Parsons and MacCallum 2017; MacCallum et al. 2017; Stanton and Ophoff 2013)	• Mobile forums • Discussion platforms

Conversational learning theory	Focuses on construction of conversations between teacher and learner and conversations amongst learners and discursive interactions (Kukulska-Hulme 2005)	(Dyson 2009; Sharples 2000)	Mobile computer supported collaborative learning (MCSCL) system-Futurelab (students have to come to agreement before the answer can be submitted) (Roschelle and Nussbaum 2005)
Experiential theory	Mobile devices can be used to support the individual's active experience. The learner discovers their own knowledge from direct practical experience rather than learning about something by listening to someone else e.g. a teacher (Dyson 2009)	(Dyson 2009; MacCallum et al. 2017)	• Learners use mobile devices to photograph, recording sound and analysing data through multiple types of experiential learning (Swanson 2018) • Mobile app to facilitate academic integrity among undergraduate learners (Tsang, Hanbidge and Tin 2018)

Motivational theory	Identifying and investigating the motivational components and processes of implementation in designing mobile-based instruction (Chang, Chang and Shih 2016).	(Giannakas et al. 2018; Chang, Chang and Shih 2016; Kearney et al. 2012)	M-learning application design drawing on motivational theory (Jeno et al. 2019)
Theory of mobile learning	It addresses the relations between mobile devices and learning. Distinguished m-learning from other forms of learning since learners: ○ Learn across space ○ Learn across time ○ Move from topic to topic ○ Move in and out of engagement with technology Learning occurs outside classrooms/lecture theatres. Considers the ubiquitous use of personal and shared technology.	(Herrington and Herrington 2007; Wali, Winters and Oliver 2008; Sharples, Taylor and Vavoula 2007)	• Field trips • Learning between activities while using mobile technologies • Informal learning while on the move using mobile devices • Mobile platforms • Discussion boards

One of the challenges is that it may be difficult to determine how learning theories have been applied to m-learning. Some of the challenges mentioned in the literature are explained below.

- In a review of experimental m-learning research based on the activity theory framework, the study proved that from a cognitive perspective, tasks in real-world contexts were complex for novices or inexperienced students (Chung, Hwang and Lai 2019).
- Although the activity theory plays an important role in understanding the integration of technology in a specific context, few studies use this theory to measure the success of m-learning (Alsswey et al. 2020). This is possibly because activity theory effectively explains the design aspect of mobile applications (Park 2011).
- The learning theory is used to design an m-learning activity rather than to measure the success of the activity. For example: (1)investigating student readiness to adopt m-learning drawing on the social cognitive theory framework (Iqbal and Bhatti 2016) and (2) use of the motivational theory in designing m-learning activities (Jeno et al. 2019; Chang, Chang and Shih 2016).

So, while some studies use learning theories as a measure of success of m-learning, other researchers incorporate learning theories in the design of m-learning activities or research of m-learning. Cochrane and Narayan (2018) demonstrate how the community of practice is used in conjunction with other learning theories such as connectivism, social constructivism in nurturing collaborative networks for both m-learning researchers and practitioners. Learning can be promoted through the use of interactive apps, in line with the conversational theory (Sharples 2002), which may be perceived as a subset of collaboration and/or social constructivism.

The theory of mobile learning addresses the issues of mobile devices and learning. It considers the mobility of the learner and that learning is not limited to a specific location. There are multiple applications that capture this, such as the use of mobile technologies during field trips, and informal learning using mobile devices. There is a variety of learning theories that can be applied to m-learning. These theories can be drawn from traditional learning theories (Naismith 2004) or non-traditional learning theories. It is evident that numerous learning theories can be adapted to m-learning. By adopting sound pedagogical theories, considering mobility and context, there is potential for exploiting the affordances of the technologies in more valuable ways.

A diagrammatic summary of the theoretical perspectives is shown in Figure 2. 4.

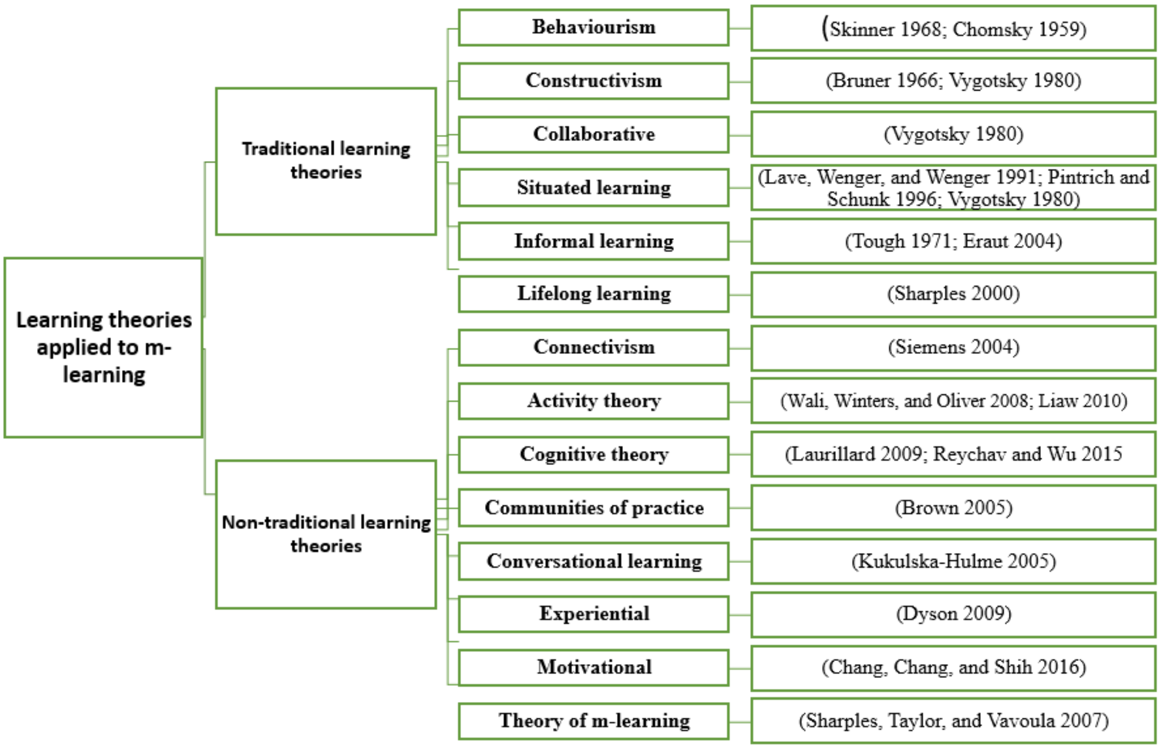


Figure 2.4. Summary of theoretical perspectives of m-learning (Section 2.4) (prepared by researcher)

2.5 Lecturers' perceptions of m-learning

Lecturers' perceptions of m-learning may have an impact on the success of m-learning implementation and may have a significant influence on students' intentions to use m-learning.

2.5.1 Superficial learning

One m-learning issue that emerged from the literature concerns lecturers' fears that m-learning will be superficial. Without elaboration, some lecturers identify superficial learning as a concern associated with m-learning (Mohesh and Meerasa 2016; Barden 2019). Being able to access information quickly and in time may be detrimental to the structure of the learning culture in a class (Spangler, Rodi and Kiernan 2016). Some lecturers feel that students become overly dependent on reminders and additional guidance given via mobile devices, rather than being independent and searching for information themselves. The increased connectivity may burden lecturers with enquiries that students could otherwise handle themselves (Handal, MacNish and Petocz 2013). In the field of medicine, lecturers have reservations about m-learning because the quick access to information prevents the “internalisation of knowledge” which has the potential to be “superficial learning” (Mohapatra et al. 2015). Australian academics were apprehensive about exposing students to superficial learning when m-learning experiences are poorly designed (Handal, MacNish and Petocz 2013). Indeed, m-learning does allow quick access to information. However, this does not guarantee a thorough understanding. Hence, when designing m-learning activities, it is essential to ensure that students do not miss out on the essence of actual learning because of integrating ICT with education. A constructivist perspective may iron out issues of superficial learning. Learners actively construct their knowledge and do not absorb it as transmitted by lecturers, because people are not recorders of information but constructors of the structures of their own knowledge (Bruner 1996; Lunenburg 1998). Rather, digital technologies should enhance the actual learning experience, and not diminish the learning culture nor expose learners to superficial learning.

2.5.2 Role of instructors

It is important to examine the role that lecturers play in m-learning implementation and adoption. One of the few qualitative studies on lecturers’ attitudes to m-learning, highlighted the need to explore understandings of m-learning rather than focus on mobile usage (Schuck et al. 2013). Schuck et al. (2013) suggest the need for deeper discussions about the complex nature of m-learning and its relationships with the developing learning landscape. Some lecturers see themselves as being responsible for encouraging learners to take up m-learning, thus changing learners’ mindsets (Paledi and Alexander 2017). Social influence has a positive effect on the acceptance of m-learning Cheng et al. (2011). Zainol et al. (2017) define superior social influence as the extent to which immediate faculty members directly encourage learners to use an m-learning service. The social influence of lecturers may be particularly important in countries were m-learning is in its infancy.

It is likely that in the initial stage of m-learning implementation, the role of lecturers may include shifting learners’ mindsets to be more accepting of m-learning, which requires a focus on mobile usage. Where m-learning has been established, the role of instructors shifts beyond mobile usage to considering how best to utilise m-learning. This can involve ways to make learning materials more accessible on mobile devices or utilize mobile devices to improve learner engagement. The lecturers’ perceptions of and attitudes towards m-learning strongly depend on the way that m-learning activities are developed and implemented within a particular context.

2.5.3 Security and privacy

Lecturers have expressed concerns about the issues of security and privacy in the adoption of m-learning. There are fears that confidential information could be exposed to students and that quality of content could be compromised by m-learning activities (Shonola and Joy 2014). In tertiary institutions, the lack of security and protection of sensitive data has been raised by both students and teaching staff (Giyane and Buckley 2015; Khan et al. 2015; Adejo et al. 2018). In a study conducted in South Africa on the use of WhatsApp to support teaching and learning in higher education, challenges reported by lecturers included the blurring of social and academic boundaries and a lack of privacy (Gachago et al. 2015). Ossiannilsson (2016) observes that some security policies in tertiary institutions are inadequate to cater for diverse mobile technologies connecting to the institution's network. However, security issues related to authenticity of instructors and learners can be tackled through policies and encryption techniques to improve security and the privacy of contents (Khan et al. 2015). Although measures can be taken to curb security issues, the great diversity of mobile technologies make networks more vulnerable to security threats.

A critical issue raised with m-learning is that mobile devices are vulnerable to cybersecurity attacks and security threats. Mobile devices are susceptible to security threats. Security concerns regarding mobile technologies include malware (which can send premium pay text messages without the user's knowledge), jailbreak (occurs when the built-in restriction on security is bypassed) and fake applications which are discussed extensively by (Patten and Harris 2013; Adejo et al. 2018). Oyelere et al. (2016), discuss security in terms of physical security and cybersecurity, and consider: (1) software attacks such as viruses, worms, service denial; (2) hardware attacks like theft and espionage; and (3) intellectual property attacks such as copyright and piracy infringement. Oyelere et al. (2015), assert that m-learning systems being multi-faceted, given their diverse and pervasive possibilities, exacerbate the security concerns.

A study by Shonola and Joy (2014) revealed that at least 60% of educators in Nigeria were concerned about: (1) virus and malware attacks on m-learning systems; (2) unauthorised access to learning content; and (3) students' unauthorised sharing of copyright material. M-learning success will depend on adequately addressing security issues. Similarly, Adejo et al. (2018) extensively discuss some of the security challenges associated with m-learning in the cloud computing environment. The challenges include top threats to cloud security such as data breaches, data loss, denial of service attacks and shared technology vulnerabilities. Kambourakis (2013) echoes educators' concerns about security and privacy, and how these concerns can impede the penetration of mobile technology in the educational realm.

The security issues raised by instructors, if not addressed adequately, could have dire consequences on m-learning in higher education in the event of a security breach. It is important for tertiary institutions embarking on the m-learning journey to have security strategies that are continually assessed to avoid financial, operational and trust issues that may arise in the event of a data breach. Part of the solution for the security concerns could be raising the awareness of learners in regard to mobile device security learners (Patten and Harris 2013). This could involve educating learners on mobile device security. CyberAware is an example of mobile game-based learning, which is data security and privacy-oriented (Giannakas, Kambourakis and Gritzalis 2015). The goal of the game is to familiarise students with cybersecurity issues and heighten security awareness. Another solution could be the integration of privacy and security features in the technological design of m-learning activities from the outset. Giannakas et al. (2018, 360), for example, propose that the following security and privacy characteristics be addressed for mobile game-based-learning applications:

- Identity confidentiality
- Location privacy
- Secure communications (data confidentiality and integrity)
- Secure data access and storage

Few qualitative studies have been conducted to determine lecturers' perceptions of and attitudes to m-learning. Such studies could give more insights in m-learning implementation. The qualitative studies so far have raised important aspects of m-learning that touch on the need to explore the complexities of m-learning rather than merely concentrating on mobile usage. While recommendations and positive attitudes towards m-learning will likely influence learners to adopt m-learning, learners of this generation may not need much encouragement to embrace m-learning as they are constantly using ICT in different activities and possibly in informal learning already. It may be more worthwhile to consider concerns raised by instructors in regard to security and privacy. It is important to take cognisance of the concerns raised by the lecturers as an underestimation of these concerns may prevent these key stakeholders from reaping the benefits of using mobile technologies in education. Although there is extensive m-learning research globally, there has been limited research focusing on lecturers and m-learning in higher education settings. A diagrammatic summary of lecturers' perceptions of m-learning is given in Figure 2. 5.

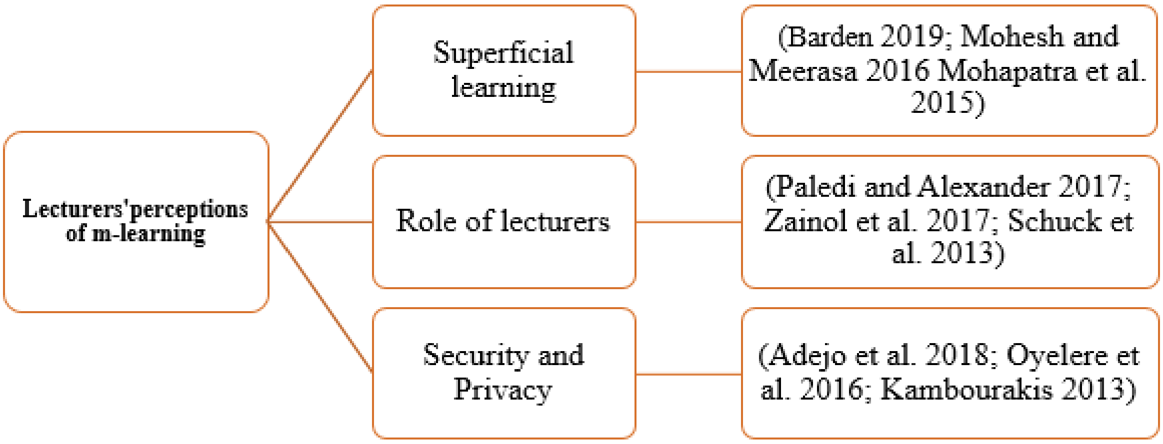


Figure 2.5. Summary of lecturers' perceptions of m-learning (Section 2.5) (prepared by researcher)

2.6 Students' perceptions of m-learning

The benefits of m-learning have been widely acknowledged. There are suggestions that higher education students may be more ready to adopt m-learning than students in other levels of learning given the increased ubiquity of mobile computing devices on college campuses (Gikas and Grant 2013). Nonetheless, to realize the benefits of m-learning, students first must adopt m-learning. The availability of mobile devices does not guarantee their use for educational purposes (Corbeil and Valdes-Corbeil 2007; Maketo and Balakrishna 2015). Therefore, it is imperative that students' readiness to adopt m-learning be assessed.

2.6.1 Positive attitude

A wide range of studies on students' acceptance of m-learning shows their positive attitude towards this learning approach (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016; Gedik et al. 2012; Iqbal and Qureshi 2012; Liu, Li and Carlsson 2010). Empirical studies on m-learning adoption involved a review of 18 studies published between 2005 and 2010. that focused on students' perceptions by (Pollara and Broussard 2011). The studies revealed that 17 of these reported a positive attitude towards m-learning. More recent studies conducted with students in different disciplines and different institutions show learners' positive attitude towards m-learning (Patil et al. 2016; MI and Meerasa 2016; Pimmer 2014; Subhash and Bapurao 2015; Iqbal 2017; Arain et al. 2018). Learners' positive attitude towards m-learning could be attributed to the fact that most learners own and use mobile devices on a regular basis. However, literature highlights the dearth of research in mobile-learning adoption and its determinants in developing countries, especially in Africa (Barker, Krull and Mallinson 2005; Iqbal and Qureshi 2012; Kaliisa and Picard 2017). While previous studies have shown students' positive attitudes towards m-learning, for communities with little research on m-learning, establishing students' acceptance of m-learning may be crucial in developing a model that is suited to a specific context.

2.6.2 User acceptance

Literature shows that over the last two decades several theories have been developed to explain, understand and predict user acceptance or intention to use new technology. Some researchers draw on the diffusion of innovations theory (Rogers 1995). Characteristics of an innovation as perceived by members of a social system determine its rate of adoption (Rogers 1995). According to Roger's model (Rogers 1995), the diffusion of any innovation (DOI) involves five steps:

1. ***Knowledge/Awareness*** – a person becomes aware of an innovation but lacks information about the innovation.

2. ***Persuasion*** – a person forms a favourable attitude towards the innovation and actively seeks related details.

3. ***Decision*** – a person decides to engage in activities that lead to their adoption or rejection of the innovation.

4. ***Implementation*** – the person uses the innovation to some extent depending on the situation.

5. ***Confirmation/Continuation*** – the person evaluates the results of the innovation to decide whether or not to continue using the innovation.

The DOI theory framework has been adopted in several m-learning studies (Doyle, Garrett and Currie 2014; Mugwanya, Marsden and Boateng 2011; Seyal et al. 2015; Alrasheedi, Capretz and Raza 2015; Traxler 2018). Other studies have examined the user acceptance of new technology based on the Technology Acceptance Model (TAM) which explains how people accept a new system (Davis 1989). The Unified Theory of Acceptance and Use of Technology (UTAUT) model developed by Venkatesh and Davis (2000) based on the TAM has become one of the most widely-used models in the information and communication and technology field. The comprehensive UTAUT model integrates eight prominent models including the theory of reasoned action, the theory of planned behaviour the motivational model (Karimi 2016). The UTAUT has been utilised to explore m-learning acceptance (Jairak, Praneetpolgrang and Mekhabunchakij 2009; Nassuora 2012; Thomas, Singh and Gaffar 2013; Alsswey et al. 2020; Kaliisa, Palmer and Miller 2019). Drawing from the work of López-Nicolás, Molina-Castillo, and Bouwman (2008), this research combined aspects of DOI and the UTAUT to examine stakeholders' motivation to use m-learning.

In determining whether m-learning will be accepted, the first two steps -knowledge and persuasion- of Roger's model may be crucial in indicating whether or not m-learning will be fully embraced by the different stakeholders. The UTAUT encompasses all aspects related to learners, but only some aspects pertaining to the rest of the stakeholders. For example, while social influence may be an important factor for learners, this may not necessarily be the case for instructors.

2.6.3 Perceived mobility

The use of m-learning in some cases has been encouraged by factors such as perceived mobility. Perceived mobility relates to user awareness of the mobility value of m-learning. Accordingly, perceived mobility is an antecedent of user acceptance of mobile learning, since learners who perceive the value of mobility also understand the uniqueness of m-learning. (Huang, Lin and Chuang 2007; Nikou and Economides 2015; Park et al. 2014; Suki and Suki 2011a) have proven the significant influence of perceived mobility on the adoption of m-learning, which reinforces the idea that mobility is key to the acceptance of m-learning.

As mobile technologies conform to the mobile nature of the learners, mobility is seen as a critical advantage of m-learning, distinguishing it from traditional educational approaches as learners can access education without the constraints of place or time (Liu, Han and Li 2010).

Students find that mobility enhances communication and enriches their educational experience (Jan et al. 2016). Furthermore, perceived mobility significantly impacts on perceived usability and the mobility value compensates for the technical limitations of mobile devices such as screen size and low battery life (Nikou and Economides 2015). Certainly, perceived mobility translates to learners accessing learning material anytime and anywhere which fosters ubiquitous learning, whose advantages will most likely influence learners' attitudes to and perceptions of m-learning adoption.

2.6.4 Perceived social pressure

Social factors can influence a learner's decision to adopt m-learning. There are suggestions that subjective norms such as perceived social pressure from peers to engage in a particular behaviour can be an important factor determining the adoption or otherwise of an innovation (Ajzen 1991). Prior research confirms that perceived social pressure can be a key element of students' interest in adopting m-learning (Huang et al. 2014; Kang and Shin 2015; Park 2009; Park, Nam and Cha 2012; Yeap, Ramayah and Soto-Acosta 2016; Ferreira et al. 2013). Fellow learners in higher education not only share classes but may also be friends or rivals. Therefore, peer approval of m-learning matters to students. On the contrary, Rehman et al. (2016) rejects the notion that social influence has significant effect on the behavioural intention to use m-learning systems. The possible reason for this outcome may have been the lack of familiarity with m-learning among a particular sample of Pakistani citizens.

It may be concluded that learners who have prior experience with m-learning can influence their classmates to use m-learning and shape other learners' intentions (particularly those with less experience with m-learning). Additionally, learners can be influenced by other learners' enthusiasm for m-learning because they see their peers as rivals and therefore will adopt m-learning to keep pace with their rivals. With peer pressure more pronounced in higher education settings, the large-scale adoption of a certain technology would positively influence the attitude of non-adopters with respect to its usefulness. It is probable that social factors will play a crucial role in environments where most of the learners are yet to appreciate the value of using mobile devices for learning.

2.6.5 Perceived usefulness

Perceived usefulness may be defined as the degree to which a person believes that using a particular system would enhance performance of a particular task. People tend to use or refrain from using an application depending on the extent to which they believe it will improve their performance on a task (Davis 1989). Literature suggests that most learners worldwide will adopt m-learning if they perceive its usefulness (Iqbal and Bhatti 2016; Liu, Li and Carlsson 2010; Briz-Ponce et al. 2017; Jung 2015; Sabah 2016; Batmetan and Palilingan 2018; Gómez-Ramirez, Valencia-Arias and Duque 2019). M-learning is a valuable means of promoting learning activities as it enables learners to make use of previously unproductive time such as commute time (Corbeil and Valdes-Corbeil 2007; Farley et al. 2015). Content is key in convincing learners to utilize unproductive time for learning purposes (Liu, Li and Carlsson 2010). Liu, Li, and Carlsson (2010), state that m-learning for the study of English language is becoming popular in China, since language proficiency is important for Chinese students who want to undertake Master or PhD studies or secure employment abroad. Therefore, in order that students embrace m-learning, they should be made aware of its long-term benefits.

Students will view m-learning positively when they are convinced that m-learning can assist them to learn and be more productive (Yeap, Ramayah and Soto-Acosta 2016). The portability of mobile technologies would appeal to learners as it enables them to access learning regardless of time and location. Moreover, as discussed in section 2.4.2, m-learning can address the issue of unproductive time, as well as offer situated learning, informal and formal learning, lifelong learning and various applications facilitating student collaboration. This suggests that m-learning, as a proven means of enhancing teaching and learning outcomes, is likely to be perceived as useful by most learners in higher education. M-learning also facilitates interactions between learners and learners and their lecturers, as well as allowing access to a wide range of resources, thereby encouraging its rapid adoption by learners.

2.6.6 Faculty and institutional support

University support is crucial to the seamless integration of technology with education. Individual uptake of any technology depends not only on personal beliefs and perceptions but also on management actions, policies and strategies (Leonard-Barton and Deschamps 1988). Several studies have reported that institutional support is a critical success factor for m-learning (Alrasheedi and Capretz 2018). A lack of institutional support and limited direction when integrating technology with learning has rarely led to successful implementation (O'Doherty et al. 2018). For the implementation of m-learning to succeed, there is need for faculty support in terms of policy, infrastructure and instructional design (Awadhiya and Miglani 2016). M-learning adoption in tertiary institutions depends heavily on faculty support (Iqbal and Bhatti 2016). Academic institutions should recognise the particular concerns and considerations that will encourage academics to either reject or welcome the integration of technology with education (O'Doherty et al. 2018). Faculty support can be in the form of persuasion to adopt a new technology by highlighting its benefits or giving practical training and assistance to lecturers and students to dispel any anxieties about the adoption of a new technology.

Effective use of technology in the higher education curricula depends on learner characteristics, use of the mobile technologies, sound pedagogical curriculum content, the educator, and the institutional support required to integrate these aspects (Sanderson and Hanbidge 2017). In communities where m-learning is already established, it is highly likely that there is some sort of institutional support. Institutional support may be of greater importance in communities where m-learning is just emerging. Institutional support may lower students' levels of anxiety when students have confidence that their instructors are available to help them out with the new technology. The instructors can be instrumental in convincing learners that a new technology will lead to increased output and better learning outcomes. It is evident that faculty support will go a long way in m-learning adoption as it can affect both learners and instructors.

2.6.7 Support mechanism

M-learning with its resources offers learners a support mechanism complementing face-to-face learning. Students would like to use m-learning to support traditional learning (Gedik et al. 2012). M-learning can facilitate learning activities by providing convenient and real-time access to information (Althunibat 2015). Portable technologies enable learners to study when and where they want. Mobile technologies facilitate anytime learning where learners can take advantage of unexpected free time as students often have their mobile devices with them.

There is no doubt that m-learning assists with teaching and learning (Reinders and Pegrum 2015). In multiple locations throughout Australia, students have made use of m-learning to take advantage of spare moments in their daily routines, and have utilised mobile technologies to store relevant content for use in class (Farley et al. 2015). Collaborative m-learning has been proven to have a significant effect on academic performance, student engagement and consistency of learning, more so than the traditional approach (Kumar and Pokhrel 2017). Collaborative learning could therefore be used to support traditional approaches to teaching and learning and students could improve their academic performance. Rather than prohibit the use of mobile devices in education, there is a suggestion that curricula should include m-learning and that m-learning should be utilised to support formal education (Talan 2020). M-learning is not intended as a substitute for face-to-face learning, but rather as a facilitator of learning activities. Therefore, it is imperative that students understand and appreciate the role that m-learning can play in their education.

A diagrammatic summary of learners' perceptions of m-learning is given in Figure 2.6.

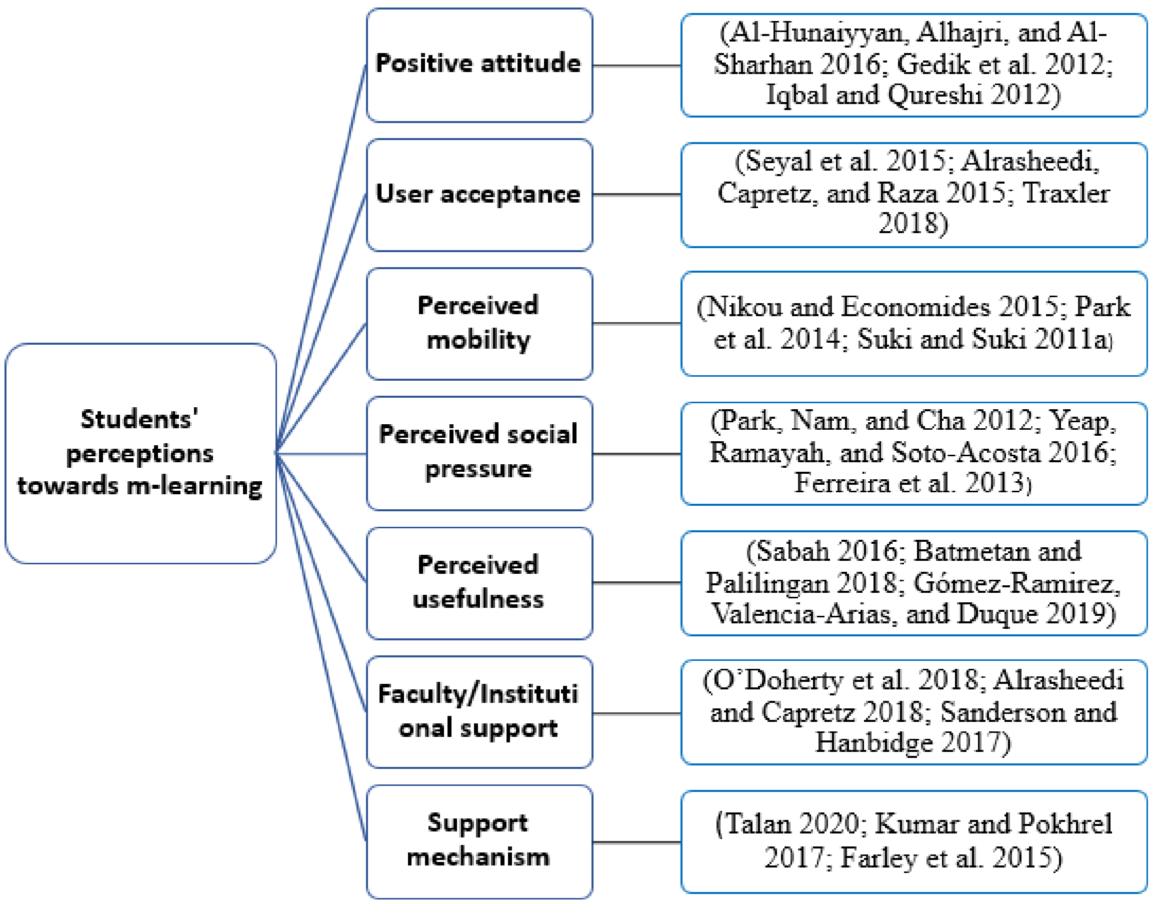


Figure 2.6. Summary of students' perceptions of m-learning (Section 2.6) (prepared by researcher)

2.7 Curriculum development and m-learning

Curriculum development is done to meet the demands of the global village. Globalisation has increased pressure on higher education institutions in countries like Zimbabwe to move towards the use of ICTs to give increased access to educational programmes (Kurasha and Chabaya 2013). Therefore, it is essential that the capacity of mobile technologies to deliver, enhance and support learning in higher education, be explored.

2.7.1 Curriculum issues with m-learning

Curriculum issues regarding m-learning are varied. A key benefit of m-learning is curriculum development (Handal, MacNish and Petocz 2013). Handal, MacNish, and Petocz (2013) further suggest that there is a need for academics to be trained in m-learning matters from both pedagogical and operational views. Academics do not have time to integrate mobile-learning into the curriculum as this increases workloads (Schuck et al. 2013). Hence, for m-learning practices to be effective in higher education, academics need to undertake professional development involving m-learning to enable them to apply rich teaching strategies when delivering their courses. However, the training must be tailored to the needs of the various disciplines as some may require a different approach.

In communities where classroom teaching is the main pedagogical approach, m-learning inevitably has a huge impact on that type of teaching. In these cases, m-learning may give rise to concerns regarding the inadaptability of the original elements of education as well as issues on how to organically integrate m-learning into the existing teaching methods (Wu and Chen 2018). Curriculum change may be the road that leads to optimising learning in diverse contexts through and around mobile technologies (Schuck, Kearney and Burden 2017). There is a suggestion that education needs to become less constrained by formal curriculum design and offer more flexible notions of curricula since learning takes place autonomously in unpredictable contexts (Schuck, Kearney and Burden 2017). Curriculum issues in relation to m-learning will vary from context to context. In environments where m-learning is in its infancy, this may include how to integrate mobile technologies with teaching and learning.

2.7.2 Curriculum development with m-learning

International organisations such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO), European Union (EU) and the organisation for Economic Co-operation and Development (OECD) have emphasized the importance of developing curricula that focus on the "core competences" in education (Hwang, Lai and Wang 2015). These competencies are: Communication, Collaboration, Critical thinking, Complex problem solving, and Creativity, all deemed necessary for the twenty-first century (Lai and Hwang 2014; Gallagher, Hipkins and Zohar 2012). M-learning can be used to achieve some or all of the five twenty-first core competencies. Hegedus, Dalton, and Tapper (2015), for example, investigated and evaluated the effect of mobile-technology-enhanced curriculum on student learning in Mathematics. This involved replacing a traditional algebra curriculum with a mobile technology approach for the SimCalc program. The study found that SimCalc offered an interactive way of learning Mathematics as it engages students and teachers in meaningful forms of communication (Hegedus, Dalton and Tapper 2015). The pedagogical approach of the SimCalc program involved problem-based learning in a formal context (Bano et al. 2018). Additionally, the curriculum development for m-learning trail in history studies provided a rich learning experience through scaffolding students' exploration of a historical battle site using mobile technologies (Cober et al. 2015). When implementing m-learning, it is important to reflect on how the curriculum will be implemented for the core competencies to be achieved.

It is claimed that the Mobile Learning Curriculum Framework (Botha et al. 2012), is the first attempt to methodically and comprehensively explore where and how mobile devices should appear in the educational provision. This framework is underpinned by three broad learning objectives: (1) to acquire domain knowledge; (2) to develop sufficient and appropriate skills; and (3) to enable m-learning practice and to understand the role and impact of domain knowledge in relation to the application context. The framework does not claim localisation relative to all possible instances of implementation but intends for institutions to choose appropriate themes and modules that best meet the institutions' needs. The framework should be commended for providing a systematic and comprehensive way to incorporate mobile devices in the education provision; this could provide a foundation for more specific mobile-learning curriculum frameworks that can be fully utilised by different institutions.

Although there is evidence that m-learning can benefit curriculum development, the advantages of offering m-learning in higher education may be hampered by curriculum issues that include pedagogical and operational issues and the lack of a proper curriculum framework to guide the m-learning practices in these institutions. In environments where classroom-based teaching is the main pedagogical method, several problems could arise from attempts to combine this type of teaching with mobile technologies. It is important to consider the current methods of teaching and the practical implications of incorporating mobile technologies into these methods of teaching.

2.8 M-learning potentials

The potentials of m-learning can be discussed in terms of the technical affordances of the mobile technologies and the m-learning characteristics. Several desirable teaching and learning outcomes can be accomplished through m-learning, which might not be achieved when using the traditional approaches. The characteristics of m-learning characteristics as well as the technical affordances of mobile technologies can facilitate these outcomes.

2.8.1 M-learning characteristics

M-learning literature has revealed several characteristics specific to m-learning, particularly those that enable learners to be at the right place at the right time (Seppälä and Alamäki 2003). The core characteristics of m-learning are its ubiquity, the portability of devices, and its ability to deliver blended, private, interactive, collaborative, and instant information (Ozdamli and Cavus 2011). It has been argued that the m-learning characteristics and issues common to developing countries are usability, collaboration, context, control, connectivity, mobility, content, blending, technical support and cost (Imtinan, Chang and Issa 2013). M-learning has the following characteristics: accessibility, immediacy, interactivity, context-awareness, permanency, flexible learning, large mass covered, lower prices relative to desktop PCs (Behera and Purulia 2013). Although Imtinan, Chang, and Issa (2013) and Behera and Purulia (2013) discuss m-learning characteristics from the perspectives of developing countries, it is interesting that with the exception of cost the characteristics are dissimilar. This variation could be attributed to the different contexts of the developing countries where m-learning should be implemented to meet the specific demands of a particular country. The differing characteristics of m-learning suggested by researchers may be an indication of the various approaches and contexts of m-learning and how the different researchers define m-learning.

Some researchers have focussed on the design characteristics of m-learning environments. Herrington, Herrington, and Mantei (2009, 134), for example, identify the following design features: real-world relevance, mobile contexts, exploring mobile technologies, blended mobile and non-mobile technologies, using m-learning spontaneously, using m-learning in non-traditional learning spaces, using m-learning both individually and collaboratively, exploiting affordances of mobile technologies, using personal mobile devices, mediating knowledge construction, and using m-learning to produce and consume knowledge. Stanton and Ophoff (2013), on the other hand, identify social interactivity, context sensitivity, personalisation, ubiquity and nomadicy as the features of m-learning. Finally, Grant (2019, 370) suggests seven characteristics that inform the design of m-learning: learner is mobile, device is mobile, data services are persistent, content is mobile, tutor is accessible, physical and networked cultures and contexts impact learning or learner, and learner is engaged.

Characteristics of m-learning from a design or application perspective should assist with the design of m-learning activities that are better suited to the educational needs of the millennial generation. M-learning may address a number of educational problems that individuals in the millennial generation face by providing learners opportunities to live, learn and perform in ways that never existed and are more than just technology-supported learning (Krotov 2015). This will likely be achieved by explicit understandings and assertions of the m-learning environments which comprise the m-learning characteristics. There is progression and diversity in the number and characteristics of m-learning. Given the evolving nature of m-learning, coupled with the continuing research in this field, it is anticipated that the characteristics may change to align with educational needs. Several m-learning characteristics are discussed in subsections below.

2.8.1.1 Portability

A special feature of mobile technologies is their portability as these handheld devices can be carried to different locations. The portability of mobile technologies enables user mobility and easy access to mobile devices (Ally and Tsinakos 2014; Asiimwe and Grönlund 2015; Barker, Krull and Mallinson 2005; El-Hussein 2010; Hsu and Ching 2015; Melhuish and Falloon 2010; Cheon et al. 2012; Abdullah 2019; Kearney and Maher 2019). Portability enables students to carry on learning outside the confines of the classroom which can foster greater feelings of ownership of the work (Ally 2005). Portability makes a difference in a variety of settings such as the classroom, a field trip or outside the school environment Barker, Krull, and Mallinson

(2005). Portability is a critical success factor for the design and development of m-learning (Papanikolaou and Mavromoustakos 2006). Mobile devices offer portability in a way that changes the pattern of learning (Laurillard 2007; Sharples 2007). Portability of devices allows a mobile learner to engage in learning that has no boundaries.

The portability of devices means that m-learning can replace books and notes (Alsaadat 2009). The portability of the devices translates to portability of large volumes of content which can be easily, rapidly and broadly disseminated (Adam et al. 2011). The portability of devices is advantageous in that it enables the transporting of and working with files at any location (Handal, MacNish and Petocz 2013), and facilitates collaboration and interaction between learners (Melhuish and Falloon 2010). Melhuish and Falloon (2010) add that the portability of such devices enables them to be passed around a group and that several mobile devices could be used comfortably by groups of students working at tables. The portability of mobile technologies enables learners to use these technologies in a number of learning contexts (Jones, Scanlon and Clough 2013). Portability of devices enables seamless learning as learners can take learning on-the-go with their mobile devices when they commute and also share and discuss ideas anywhere anytime (Hsu and Ching 2015). Hsu and Ching (2015) give an example of how learners, while commuting, can use mobile devices to search for information that was given in class or picked up in a conversation. The portability of mobile technologies is undeniably a major advantage of m-learning and other characteristics of m-learning hinge on this characteristic.

2.8.1.2 Affordability

The affordability of mobile devices is a relative issue, although the increase in mobile penetration rates demonstrates significant growth. For technologies to be viable in education, they must be affordable (Adam et al. 2011). M-learning has become attractive because of the cheaper costs of mobile devices coupled with the increased capabilities of these devices (El-Hussein 2010; Iqbal and Qureshi 2012; Vishwakarma 2015; Oyelere and Suhonen 2016). In developing nations, the pervasiveness of affordable mobile devices with increased capabilities augurs well for the integration of mobile technology with education practices.

Although cost remains a barrier to people in most parts in the world, m-learning provides relatively cheaper opportunities of integrating education with technology as mobile devices are cheaper than PCs or laptops (Cavus and Ibrahim 2009; Elias 2011; Mehdipour and Zerehkafi

2013). M-learning has the potential to reduce overall education or training costs, by excluding the need for traditional classroom learning, use of printed materials, lost production time and the presence of an on-site instructor (Crescente and Lee 2011). Some mobile service providers offer reduced cost services for educational use; such schemes would greatly reduce the implementation costs of m-learning (Cavus and Ibrahim 2009). The size of mobile devices and their inherent portability facilitates information sharing as a method of lowering access costs more easily (Elias 2011). Although mobile devices are relatively cheaper than PCs, the affordability of technologies cannot be generalised, especially in developing countries.

2.8.1.3 Ubiquitous

Another key aspect of m-learning is its ubiquity. Ubiquitous computing is on-demand computing power by means of which users can access computing technologies whenever and wherever they are needed (Peng et al. 2009). The ubiquitous nature of m-learning makes it available everywhere and on various platforms (Toperesu, Van Belle and Turpin 2019). Increased attention towards m-learning is a result of the increase of mobile devices with more sophisticated technological capabilities (Iqbal and Qureshi 2012). The portability of mobile devices means the device can be carried anywhere, so learning is available to the user in a ubiquitous manner (Chen, Chang and Wang 2008; Naismith 2004; Orr 2010). It is gradually becoming common that most people who are looking for a computing platform turn to mobile devices as a first choice as these devices enable ubiquitous access to information (New Media Consortium 2011). Most students are competent with ubiquitous technologies and for most of these learners, mobile devices play an important role in their daily social networking (Herrington and Herrington 2007). Ubiquitous learning is continuous, and mobile computing devices enable learners to communicate at any time and place (Grant 2019). M-learning transforms the traditional classroom to learning anywhere anytime (Ally 2005; Ally and Tsinakos 2014; Cobcroft et al. 2006; Crescente and Lee 2011; Ozdamli and Cavus 2011; Melhuish and Falloon 2010). Ubiquitous learning supported by mobile technologies offers learners opportunities to learn in their own environment.

Mobile technologies make context sensibility possible. It is feasible to supply information about the subject's situation and environment in a dynamic and autonomous way which contributes to the subject's learning in the real world (Ferreira et al. 2013). When people can learn anywhere and at any time, learning is ubiquitous and continuous across environments and contexts (Hwang and Tsai 2011). However, while m-learning devices are ubiquitous, access to m-learning may be non-existent or unreliable (Crescente and Lee 2011). Crescente and Lee (2011) highlight that even in highly developed countries, there are gaps in access to broadband which would make m-learning impossible. Although mobile technologies have become more pervasive, issues of poor connectivity may still make m-learning a challenge.

The nature of ubiquitous learning may also present its own challenges, particularly in regard to evaluation (Hsu, Ching and Snelson 2014). The challenges of evaluating m-learning involve measuring m-learning processes and outcomes, as well as assessing the utility of mobile technology (Vavoula and Sharples 2009). Other challenges presented by the ubiquity of m-learning include learners being distracted by off-task behaviours such as accessing irrelevant online resources in class, exchanging instant messages or playing games installed on mobile devices (Peng et al. 2009). The mobile devices and their ubiquitous nature by themselves do not change education; it is the application of these technologies that can affect how students learn and address educational issues. Although the ubiquitous nature of mobile devices provides numerous advantages and positively influences how knowledge can be acquired, the noted concerns associated with the ubiquitous devices should not be simply overlooked. By finding means to overcome these challenges, m-learning may become part of the solution to current educational challenges.

2.8.1.4 Blended

Blended learning is the thoughtful integration of two main components: face-to-face classroom instruction and computing technologies; however, it is not merely a matter of just adding on to an existing dominant approach (Garrison and Kanuka 2004). Effective blended teaching and learning requires the commitment to integrate ICTs for more than “bolt on” information provision but rather to enable engagement, connection and to create a scholarly atmosphere where learners can participate flexibly (Cobcroft et al. 2006). Technology that is used to support learning should be blended seamlessly and unobtrusively in a similar way that learning is blended with everyday life (Naismith 2004). Hence, blended learning can maximise the benefits of both face-to-face and online methods of teaching and learning (Ocak 2011). Mobile technologies are a useful tool for blended learning if applied thoughtfully.

The blended learning approach has a number of advantages. Dziuban, Moskal, and Hartman (2005) discuss the following advantages of blended learning that revolve around accessibility, course interaction and pedagogical effectiveness for tertiary students: (1) students are attempting to balance family, jobs and university life; (2) most students have other time demanding activities making it difficult for them to go to campus; (3) tertiary institutions reach and retain students by providing learning materials on the Web, thereby giving students greater flexibility; (4) students have the ability to access the learning resources at any given time at their chosen location which makes it convenient and flexible; and (5) blended learning reduces time and space commitment. Köse (2010) suggests two advantages of the blended learning approach: (1) it provides learners with a more efficient learning environment which is characterised by more interactions and learning support through the online resources; and (2) the approach can improve the quality of face-to-face meetings provided that students can benefit from the online activities and resources. In higher education, blended learning aims to extend teaching and learning beyond the limits of time and space (Vaughan, Cleveland-Innes and Garrison 2013). The advantages of blended learning address issues of busy lifestyles by offering flexibility and engaging interactions.

A meta-analysis study demonstrated that blended learning can result in better learning outcomes for tertiary students (Vo, Zhu and Diep 2017). The use of mobile technologies in a blended learning mode would maximise the advantages of both types of learning and possibly offset some potential issues of the individual learning modes (Zhou and Li 2019). For instance, blended m-learning worked particularly well for collaborative problem-solving in a drama class (Fleming et al. 2016). Blended learning improved learner engagement and learning outcomes in drama-based language teaching (Yang 2011). Blended learning resulted in effective learning through increased learner participation in museum learning (Hou et al. 2014). There were improved grades in a digital media and society course for undergraduate students (Brand et al. 2011). WhatsApp was also successfully utilised for blended learning, significantly increasing students' knowledge (So 2016). More recently, social media platforms were used to train students in critical thinking in a physics class (Kustijono and Zuhri 2018). Traditional teaching methods blended with m-learning can improve pedagogy as well as students' learning experiences and academic outcomes. Going beyond the traditional face-to-face mode will ultimately offer other ways of delivering knowledge which have proved to be beneficial to learners.

2.8.1.5 Collaboration

Collaborative learning means that learners undertake learning tasks in a manner that involves sharing, negotiation and interaction. In socio-cultural theory, collaboration is often seen as involving interactions with more capable peers or adults for the purpose of learning, and there is a pedagogical emphasis on scaffolding (Tudge 1992). M-learning fosters collaboration opportunities for learners (Brown 2005; Crescente and Lee 2011; Ferreira et al. 2013; Traxler and Kukulska-Julme 2005). A key feature of m-learning is that learners can collaboratively perform activities in the classroom or via remote connection. Such interactions support the essential characteristics of a shared learning environment (Parsons, Ryu and Cranshaw 2006). Kukulska-Hulme et al. (2009) highlight the importance of learner collaboration and the ability to support collaborative and conversational learning outside the classroom through m-learning. Collaboration using mobile technologies can be achieved through various platforms such as blogs, docs, audioconferencing, bulletin boards and shared feeds (Crescente and Lee 2011; Kukulska-Hulme and Shield 2008). Kukulska-Hulme and Shield (2008) pointed out that most studies describe m-learning systems that support collaboration between instructors and learners, with their study being one of the few that investigates and confirms the value of learner-learner collaboration. Corbeil and Valdes-Corbeil (2007) discussed the potential of global collaboration through m-learning. Cochrane (2014) has since demonstrated learner-to-learner collaboration on an international level across five countries within the Icollab11 project.

There is evidence of positive perception of m-learning because it allows collaboration with instructors and other students (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016). Mobile-learners enjoy a high level of collaboration by making connections to peers, teachers, experts and resources facilitated by mobile technologies (Kearney et al. 2012). In so doing, learners not only consume “content” but also create and exchange “content” and share information and artefacts across time and place. A comparative study of computer and mobile phone-mediated collaboration investigated students’ collaboration experiences, their difficulties and opinions when they engaged in online discussions (Mendoza 2014). The study explored the impact that two types of media had on the students’ final outcomes. The study determined that mobile phones had great potential to enhance interaction in online collaboration.

An m-learning framework used to investigate m-learning scenarios, identified potential collaboration problems with Augmented Reality (AR) in informal settings like museums (Kearney et al. 2012). This was more so for solitary activities that lacked social interaction. To address a similar problem of lack of collaboration in solitary AR activities, the learning experience is supplemented by having students pair up and create a collaborative video blog (Pachler, Bachmair and Cook 2010). Yoon et al. (2012) also investigated the dynamics of collaboration in the informal setting of a museum. Their findings indicate that collaboration played a significant role in the knowledge-building approach as learners work discursively to identify and solve problems and share understandings. Collaboration takes many different forms in m-learning with the focus shifting from instructor-learner collaboration towards more of a learner-learner collaboration. The studies reviewed provide evidence that collaboration enables knowledge sharing and, in the process, gives students a better understanding of the subject matter both in informal and formal settings. This may translate to more student engagement with the learning process.

2.8.1.6 Interactive

Mobile technologies have numerous interactive features that give instant access to a broad range of learning resources. Since mobile technologies are inherently interactive, students need to learn strategies and skills for searching and evaluating information and meaningfully collaborating online (Traxler 2013; Cheng et al. 2010). M-learning provides an interactive learning environment that ensures students' active participation as the features of mobile technologies allow varying levels of interactivity (Ozdamli and Cavus 2011). Moreover, since m-learning encourages learner interaction, learners develop a greater sense of community with their peers (Ally and Tsinakos 2014). Additionally, m-learning enables greater peer-to-peer communication and also increases interactions between learners and instructors (Sánchez and Isaías 2014). Mobile connectivity enables learners to get immediate feedback by enabling learners to interact with their peers or instructors (Uzunboylu, Cavus and Ercag 2009). Uzunboylu, Cavus, and Ercag (2009) further suggest that the interactive nature of mobile technologies serves as a means of accessing, discovering, and sharing subject matter as students' converse, question each other and share opinions on the subject matter.

M-learning in higher education encourages student engagement because of the interactive features of mobile devices (Gikas and Grant 2013; Farley et al. 2015; Alvarado, Coelho and Dougherty 2016; Ferreira et al. 2013). Students in Australian universities who had recently graduated from high schools which incorporated technology in classroom teaching were surprised by the lack of use of innovative technologies in university classes and preferred more interactive learning using mobile technologies (Farley et al. 2015). When using mobile devices, students are more motivated and engaged in their learning (Alvarado, Coelho and Dougherty 2016). Engagement was observed in adults in a literature course despite the adults being unfamiliar initially with m-learning technology (Behera and Purulia 2013). In this digital era where most students, particularly those in tertiary institutions, have grown up with technology, it is expected that most learners will enjoy using mobile technologies for their learning as they already use these technologies on a daily basis for other activities.

University students engaging in peer-to-peer online interactions showed positive attitudes towards academic achievements in course subjects (Lan et al. 2012). For learners separated by time and space, interactive learning can reduce the loneliness associated with distance learning, thus bridging the distance between learners and between learners and their institution (Muyinda et al. 2011). In addition, m-learning can support individual learning via social networking, where teaching is no longer centred on the teacher's role but on students who can assist each other and also directly interact with instructors (Ferreira et al. 2013). Learners and instructors can therefore support each other and learn from each other. The inherent interactive nature of mobile technologies enables learners to interact at different levels. Learners cease to be passive, but become active participants in the learning process. There is evidence that the interactive nature of m-learning enables learners to engage more and opens opportunities for collaboration as learners interact with learning resources, peers and instructors.

2.8.1.7 Context

Situated context is a critical feature of m-learning. Context is a central construct of m-learning. Context is continually created by people interacting with other people, their surroundings and their everyday tools (Sharples, Arnedillo-Sánchez, et al. 2009). Although m-learning is strongly promoted for enabling learning anywhere anytime, a key affordance of m-learning sometimes neglected in emphasising learning anywhere anytime is the concept of m-learning *at this time, in this place,* which determines whether mobile technologies can be used in a specific context (Ally and Tsinakos 2014). Some of the possibilities of context-aware m-learning include learning that is informed by the history, surroundings and environment of learners (El-Hussein 2010; Gikas and Grant 2013; Herrington and Herrington 2007; Naismith 2004; Melhuish and Falloon 2010; Lindsay 2016). Frohberg, Göth, and Schwabe (2009) raise two challenges associated with learning in context: (1) scaffolding and moderating the process of learning (control); and (2) both instructors and learners are in danger of losing track of on-going activities.

There should be compatibility between the technology used in class and the one used by practitioners in the field so that students have opportunities to apply their knowledge and skills in realistic contexts (Arambewela, Koralagama and Kaluarachchi 2012). Some aspects of context are also explored in Section 2.4.2.4. When implementing m-learning, care should be taken to ensure that in the different contexts and times, the knowledge produced is not fragmented, but comprehensive. The interactive characteristic of m-learning can assist in the control of the learning as the learner communicates with the instructor. Interaction can also assist both instructor and learner to keep track of the activities.

2.8.1.8 Personalised Learning (Flexibility)

Personalised learning means that learning activities are customised according to the preferences and abilities of individual learners or groups of learners (Attewell 2005; El-Hussein 2010; Hsu, Ching and Grabowski 2014). The flexibility of m-learning enables participants to learn in their own time and at their own pace (Jacob and Issac 2007; Dziuban, Moskal and Hartman 2005). Personalised learning recognizes diversity, difference and individuality as well as the context and history of each individual learner Traxler (2007). Since learners have access to a variety of resources and communities that share the same interests even in different locations, personalised learning produces a dynamic educational experience (Crescente and Lee 2011). Personalised learning activities keep learners engaged and improve learners' productivity and effectiveness (El-Hussein 2010). Personalised learning exerts a democratizing effect on the learning experience as learners take more responsibility for their learning instead of passively waiting for lecturers to give them information (de la Pena-Bandalaria 2007).

M-learning enables learners to have personalised learning based on their characteristics, preferences and available tools and applications without the constraints of time and space (Brown and Mbati 2015). This flexible approach to learning entails identifying the students' personal needs i.e. their preferred learning style, knowledge, interests, goals etc. based on the personal learning environments that are most suitable for them (Kurilovas 2015). A case study involving the development of a decision support system for m-learning proved that personalised learning was the most important factor in m-learning from the perspectives of both instructors and learners (Chiu and Huang 2016). Likewise, in a different study with experts from the fields of education and education technology, personalised learning was the most highly ranked principle for effective m-learning design (Burden et al. 2019). With more emphasis on differentiated learning in contemporary school curricula, it is not surprising that educators value personalised learning.

While literature acknowledges the flexibility offered by m-learning, it has been pointed out that as the learner moves from one context to another, there is a greater risk of interruption, distraction and reduced concentration (Terras and Ramsay 2012). Interruptions may be in the form of attentional distractions, noise and changing temperature, which have the potential to disrupt the engagement of the mobile learner. With learners more in control of their learning, learners are likely to be more aware of how a context change may lead to disruption of their learning. Personalised learning gives learners autonomy and allows them to determine their own pace. This flexibility allows learners to fully grasp concepts or re-visit the concepts if necessary, unlike situations where learners are expected to move at the same pace despite their individual differences. Mobile technologies are a tool that can support personalised learning in numerous ways and simultaneously cater for the diversity of learners.

2.8.1.9 Usability

Usability is significant in m-learning as it involves interaction with technology. According to the ISO 9241-11 Standard of 1997, usability is defined as the extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and satisfaction (FDIS 1997). Usability refers to the degree to which a system is easily learned and used by its users (Isaias and Issa 2015). Usability ensures that interactive products are easy to learn, effective to use and enjoyable to use from the user's perspective (Rogers and Preece 2011). Mobile device characteristics such as capacity, speed of device memory and size and structure impact on usability (Koole 2009). Literature pertaining to m-learning shows that a key factor that encourages learners to adopt m-learning is its perceived ease of use (Huang, Lin and Chuang 2007; Iqbal and Bhatti 2016; Liu, Han and Li 2010; Mac Callum and Jeffrey 2013). Usability of mobile devices is a problem that has raised multiple complaints including the smallness of the screen and the keypad (Lu and Tang 2019). Lu and Tang (2019), however, concede that mobile devices enable quick access to and interaction among fellow learners.

Content is most useful to learners when it is designed specifically for a small screen (Levene and Seabury 2015). On the other hand, some researchers when considering the usability of mobile devices, have focused on how mobile technologies are an effective tool for collaboration and facilitation of authentic learning, particularly in higher education (Oldfield and Herrington 2012; Hsu and Ching 2013). Educators should consider usability issues such as technological problems when employing mobile devices for learning, and explore appropriate resources and tasks for the instructional situation (Swanson 2018). Closely related to usability is Human Computer Interaction (HCI). For computer–based systems to be widely accepted and used effectively, they need to be designed for the needs and capabilities of the people for whom they are intended (Isaias and Issa 2015). Isaias and Issa (2015) add that the goals of HCI are to produce usable and functional systems that users like. Mobile Human Computer Interaction focusses on why and how people act and interact with data accessed through a mobile device (Botha, Herselman and van Greunen 2010). Stanton and Ophoff (2013) discuss m-learning design proposed by different researchers, which cover various aspects of m-learning including content development, collaboration and the importance of creating a connection between what happens in the classroom and what is delivered through the mobile device. The diversity of available mobile technologies means their usability will vary. Learners and instructors alike need to consider the technological challenges of the mobile devices they use, with instructors ensuring that appropriate tasks and resources are utilised for effective m-learning. It can be concluded that m-learning implementation will be affected by the usability and the HCI aspects of devices. Therefore, it is important to create suitable designs for use with mobile technology from both the designers' and the learners' perspectives. For the successful implementation and adoption of m-learning, the input and output capabilities of mobile devices must be considered. The value of mobile technologies in educational settings will depend on the technology's usability.

2.8.1.10 Cost

The cost of m-learning can be considered from two perspectives, the cost to the end-user and the cost of implementation. The cost to the end user can be a barrier to the successful uptake of m-learning (Kukulska-Hulme and Shield 2008) although the decreased cost of mobile devices have made m-learning attractive as a medium for knowledge dissemination (Iqbal and Qureshi 2012; Ferreira et al. 2013). The procurement cost of mobile devices is only a fraction of the total cost incurred, suggesting that the total cost (including infrastructure) of m-learning implementation is a critical factor (Adam et al. 2011). In some developing countries like Zimbabwe, Rwanda and Tanzania (Karunaratne, Peiris and Hansson 2018), the cost of technology and the financing of ICT projects is a significant problem.

Tight budgets hinder m-learning implementation, typically in developing countries (Asabere 2013). High bandwidth costs are a major factor preventing the diffusion of mobile technology in tertiary institutions in Zimbabwe (Kabanda 2014b). Cost has been mentioned as a major constraint in integrating technology with education in some developing countries, and the impact is evident in slow speed Internet connections, irregular power supplies and inadequate bandwidth (Chitiyo and Harmon 2009). A review of challenges associated with m-learning highlights the high cost of the Internet in some developing countries such as South Africa and Tanzania (Kaliisa and Picard 2017). It is anticipated that the cost of mobile devices will continue to decline; however, the cost of mobile technologies alone is not the deciding factor when implementing m-learning. Implementation of any Information System is costly, in addition to efforts for its deployment. It is therefore important to identify factors that affect the acceptance of m-learning to ensure its success. The total cost incurred by the learner should also be considered. A more significant cost is that of implementing m-learning, which can ultimately prohibit the integration of technology and education.

2.8.1.11 Technical Support

The absence of technical support can adversely affect m-learning. Technical support includes giving users access to infrastructure and technical assistance to ensure that the mobile technology serves the needs of teachers and students (Ng and Nicholas 2013). There is a need for technical support for instructors, especially in developing countries where it is inadequate (Adam et al. 2011). Technical support is a reliable determinant factor for the adoption of new learning media (Munguatosha, Muyinda and Lubega 2011). M-learning success depends on the availability of reliable technical support (Herro, Kiger and Owens 2013; Handal, MacNish and Petocz 2013). In order for m-learning to be successful, technological infrastructure and technical support for learning activities must be adequate (Talan 2020; Al-Adwan, Al-Madadha and Zvirzdinaite 2018). M-learning involves people interacting with devices, and the ease and confidence with which they use these devices for their learning will depend on the reliability and efficiency of the technical support.

2.8.1.12 Training

M-learning implementation means that both instructors and learners will encounter change and a new way of doing things. There is need for staff development when integrating technology with education (Chitiyo and Harmon 2009; Sife, Lwoga and Sanga 2007). In most institutions, training for instructors is often neglected (Andersson and Grönlund 2009). Instructors require training from a pedagogical and technical perspective (Handal, MacNish and Petocz 2013). Training addresses challenges such as lack of instructor confidence about technology use and difficulties with mobile devices which affect attitudes towards use (Asiimwe and Grönlund

2015). Tertiary institutions should focus on training lecturers on ways to incorporate mobile technology in their teaching practices (Iqbal and Bhatti 2016).

Tertiary institutions need to provide training opportunities for students on the functions and applications of m-learning (Cheon et al. 2012; Welsh et al. 2018; Ajayi, Ayo and Olamide 2019; Bhuasiri et al. 2012). Training for both faculty members and learners is important for successful m-learning implementation (Barker, Krull and Mallinson 2005; Iqbal and Bhatti 2016). The lack of effective training of secondary teachers was reported as a reason for negative attitudes towards the use of mobile devices in education. It is advisable to train educators for successful m-learning implementation (Kaliisa, Palmer and Miller 2019). It should be noted that while training is crucial for both instructors and learners in order for m-learning to be successful, it is costly. A diagrammatic summary of the m-learning characteristics is shown in Figure 2. 7.

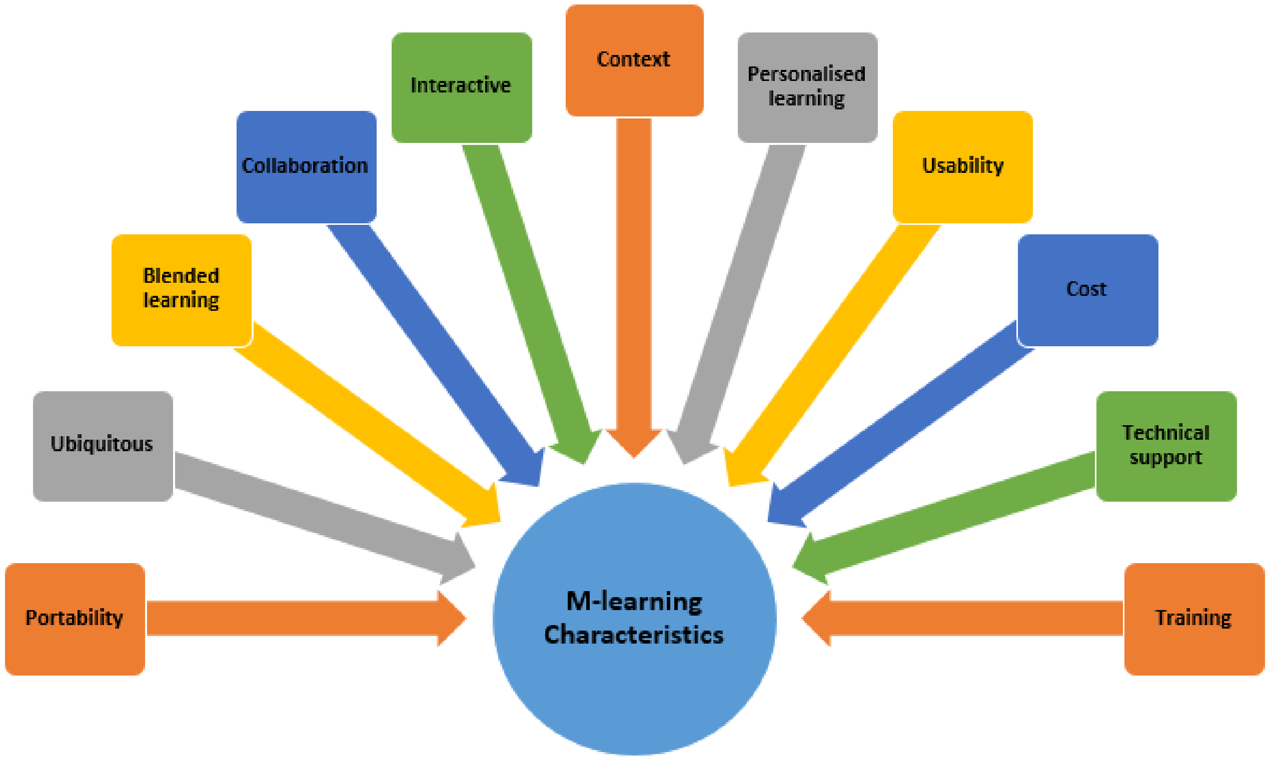


Figure 2.7. Summary of m-learning characteristics (Section 2.8.1) (prepared by researcher)

2.9 M-learning challenges

M-learning offers substantial benefits that can enhance the overall learning experience (Pollara and Broussard 2011; Sharples, Arnedillo-Sánchez, et al. 2009; Jeno et al. 2019). M-learning implementation, however is replete with challenges (Zhou and Li 2019; Toperesu, Van Belle and Turpin 2019; Lu and Tang 2019; Kearney and Maher 2019). The challenges can be broadly categorised as infrastructural, pedagogical, policy and perception-based (Kaliisa, Palmer and Miller 2019). The diverse m-learning challenges are explored in detail below.

2.9.1 Infrastructure

M-learning initiatives remain poor in some developing nations because of a myriad of obstacles. A lack of appropriate and adequate infrastructure for formal learning in developing countries often makes it difficult to integrate mobile technology in higher education institutions (Lamptey and Boateng 2017; Kaliisa and Picard 2017; Asiimwe, Grönlund and Hatakka 2017; Quaglio et al. 2016; Ajayi, Ayo and Olamide 2019; Okai-Ugbaje, Ardzejewska and Ahmed 2017). The infrastructure required for m-learning includes the technologies as well as the social amenities. There is international recognition of the crucial role of technology infrastructure in integrating education with information and communication technologies (ICT).

2.9.1.1 Poor electricity supplies

A major infrastructural impediment to m-learning adoption is the lack of a reliable electricity supply, which is an underemphasized factor affecting technology use especially in the developing world (Armey and Hosman 2016). Electricity is essential for ICT applications. Numerous initiatives have failed to consider the ability to power the technology that is central to such development efforts. Power constraints in developing nations have largely prohibited the adoption of IT-related activities (Hosman and Baikie 2013; Churchill, Pegrum and Churchill 2018). The major issue of electricity can be remedied by use of solar panels, although this solution is more expensive than commercial power (Traxler 2013). There is a need to address the issues of poor electricity supplies and inexpensive electricity supplies (Ajayi, Ayo and Olamide 2019; International Telecommunication Union 2018). Solar energy is more practical and can be implemented incrementally, although solar installation would be very costly on a massive scale and will add to the cost of the mobile solution.

2.9.1.2 Poor Internet connectivity

Poor Internet connectivity is another infrastructural barrier to m-learning implementation. Connectivity is crucial to providing access to learning resources. While Internet connectivity is almost ubiquitous in the developed world, this is not the case in most developing countries (Ford and Leinonen 2009; O'Doherty et al. 2018; Churchill, Pegrum and Churchill 2018). The potential impact of technologies on education in developing countries, particularly in Africa, is promising as it fosters a more open approach to learning.

However, in tertiary institutions in Zimbabwe, Internet connectivity is inconsistent, with low bandwidth and congested networks (Sibanda and Musungwini 2015). Internet connectivity can be affected by various factors such as physical barriers in mountainous regions (Ally and Tsinakos 2014). Moreover, in developing countries, Internet connectivity may be poor because of the costs involved (Adam et al. 2011). While demand for bandwidth within universities in Zimbabwe is on a constant rise, it is the unrestricted access to the Internet in these institutions that exacerbates the problem (Chitanana 2012). Poor Internet connectivity is a barrier to m-learning. However, it can be argued that if the benefits of m-learning are recognised and if m-learning is used appropriately, this could increase demand for Internet access and may help to improve Internet connectivity (Adam et al. 2011). In emerging economies, Internet access is closely linked to national income, meaning that poor economies are likely to have little Internet access (Pew Research Centre 2015). Inconsistent Internet connectivity will make it difficult to implement m-learning.

2.9.2 High investment costs

A major barrier to m-learning adoption is the high initial cost of investment. There are high costs associated with equipment, connectivity, technical support, training, and maintenance. Implementation costs are always a factor in any project; however, this factor is more pronounced when implementing m-learning in developing countries because of the lack of an infrastructural basis for development (Adesope, Olubunmi and McCracken 2007; Almarabeh and Majdalawi 2018; Lamptey and Boateng 2017). To reduce the risk of failure, the high investment required to establish an m-learning environment makes it imperative for institutions to prepare well before designing and implementing m-learning Bakhsh, Mahmood, and Sangi (2020). Investment costs for m-learning implementation and maintenance could be reduced through cloud computing (Mallya and Srinivasan 2019; El Mhouti, Erradi and Nasseh 2018).

Another challenge is posed by bandwidth costs which can be very high for tertiary institutions, particularly in developing countries (Chitiyo and Harmon 2009; Oye, Salleh and Iahad 2011; Mars 2012). The bandwidth at Zimbabwe tertiary institutions has been described as “too little, too expensive and poorly managed” (Chitanana 2012, 67). Chitanana (2012) recommends bandwidth management to help tertiary institutions to use the available bandwidth effectively and efficiently. In 2016, Zimbabwe’s fixed broadband monthly subscription was three times that of the US and the UK (Baller, Dutta and Lanvin 2016). This is evidence that Zimbabwe may experience huge challenges in implementing m-learning on a large scale given the costs of bandwidth and would require tertiary institutions to find financial resources. Proper management of the available bandwidth may be a way to ensure its efficient use, which may reduce costs in the long run. Apart from hardware and software purchases, there are recurrent costs associated with maintenance and support. Apart from better management of bandwidth resources, another way to reduce costs is to take advantage of the mobile cloud.

2.9.3 Policy

A country’s policies can determine the success or failure of m-learning implementation. Sustainable deployment and utilisation of m-learning depends on an appropriate m-learning policy (Muyinda et al. 2011) as the lack of policy support and lack of awareness by policy makers can be a barrier to m-learning (Mehdipour and Zerehkafi 2013). Policymakers should create or revise m-learning policy at both local and national levels. Policies should be localised to suit the local contexts of the region or country, and strategies should complement rather than replace the current infrastructure (Mehdipour and Zerehkafi 2013). When there is little knowledge of the multidimensionality of technological solutions for education, policy-makers might formulate unrealistic expectations (Lowyck 2014). It is recommended an m-learning policy be established when implementing m-learning in tertiary institutions in developing countries (Mahenge and Sanga 2016; Annan, Ofori-Dwumfuo and Falch 2018). UNESCO has provided guidelines on m-learning policy designed to assist developing countries which do not as yet have mature policies of their own (Parsons 2014). Hence, the successful implementation of m-learning is likely to depend heavily on policy.

Some educational policies restrict the use of mobile devices for learning in developing countries. In some countries, government officials are unaware of the potentials of m-learning (Mehdipour and Zerehkafi 2013; Traxler 2013). The pressure for change in education moves from top-down and this has profound implications for the policies (Acedo 2014). The World Bank maintains that developing countries have faced challenges in adapting policies and regulations to rapid changes in technology and market structures (Adam et al. 2011). There is need for political backing and support from policy makers when integrating technology with education (Andersson and Grönlund 2009). The absence of an IT integration policy framework can be a barrier to m-learning (Chitiyo and Harmon 2009). M-learning can be beneficial to all involved on condition that necessary policies are in place Barker, Krull, and Mallinson (2005). Some ICT policies are not supported by clearly defined strategies, making policy implementation difficult (Adam et al. 2011; Mfaume 2019). M-learning implementation strategies require policy makers to be well-informed on technology and to seek opinions from relevant stakeholders and ICT vendors (Asabere 2013). M-learning success may depend heavily on comprehensive ICT policies that are clearly defined and backed by well-resourced strategies. It may be necessary to have more specific policies for m-learning. The use of mobile technologies is still emerging in some developing countries which may present a challenge, as the current ICT policies might not adequately address the use and integration of these technologies in education. Effective policies should be supported by relevant stakeholders who embrace and understand the policies.

2.9.4 Social and cultural challenges

There are cultural norms and social concerns to be considered when implementing m-learning. Cultural differences in relation to perceptions of and attitudes toward technology are key factors for acceptance of m-learning and its future use. The intersection of m-learning with culture should be explored, particularly in developing countries. The increase of mobile devices and research conducted in developed countries assumes that m-learning is a natural fit for all mobile users; such assumptions can be challenged in terms of other less-researched contexts (Pouezevara 2015; Lamptey and Boateng 2017). Understanding that different sections of society perceive and interpret mobile devices differently is important for enabling a meaningful integration of mobile technologies in education.

In Botswana, mobile devices are not perceived as educational tools, but rather as tools for communication and entertainment (Maketo and Balakrishna 2015). Similarly, in Ghana, mobile phones are used mostly for communication (Sey 2011). In Kuwait, the conservative attitudes of students and instructors and the society at large regarding the use of mobile devices might negatively affect the implementation and adoption of m-learning (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016). On the other hand, students in the USA embraced mobile devices and used them as collaborative and informal learning tools (Gikas and Grant 2013). It is evident that different societies differ in their attitudes and perceptions of their interactions with mobile technologies. An understanding of the cultural boundaries and social environment of developing countries, before implementing mobile technologies for teaching and learning, can play a significant role in their success (Keengwe and Bhargava 2014). In developing countries, it has been noted that culture affects attitudes and behaviours towards the integration of technology with education (Thomas, Singh and Gaffar 2013). An understanding of the way that learners perceive mobile technologies can pave the way to m-learning implementation.

Institutional culture can be a barrier to m-learning implementation (Torres, Evans and Schneider 2019). If the leadership of tertiary institutions does not value the use of mobile technologies for teaching and learning, the success of m-learning may be compromised. Lecturers may resist change if they believe that m-learning will increase their workload as it calls for additional arrangements (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016). This resistance by academics reduces the chance that m-learning will be adopted (Messinger 2011). This resistance has also been attributed to the lecturers' lack of technical know-how and lack of finances for professional development (Herro, Kiger and Owens 2013). Socio-cultural factors play a crucial role in m-learning implementation and adoption, particularly in developing countries. Prior to the integration of mobile technologies with education, the significant differences in the attitudes, values, and societal assumptions about mobile technologies should be considered, especially in developing countries. It is therefore not practical to implement "a one-size-fits-all" model when integrating mobile technologies with education.

2.9.5 Technical challenges

Technical restrictions are a significant factor in the implementation and adoption of m-learning. Some of the technical difficulties in integrating technology in higher education include installation, lack of availability of the latest technology, poor Internet connections, intermittent power supplies, security and absence of technical support (Qureshi et al. 2012). The technical limitations of mobile technologies include: limited battery life, screen size, multiple standards and multiple operating systems (Alsaadat 2009; Asiimwe and Grönlund 2015; Mehdipour and

Zerehkafi 2013; Park 2011). Other technical challenges when implementing m-learning projects are infrastructure, application development and the level of technical knowledge that various stakeholders may have (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016). Technical limitations associated with m-learning are diverse and, while some can be controlled, others are more difficult to deal with and may require a huge amount of financial support.

2.9.6 Management and institutional challenges

Within the educational environment itself, in tertiary institutions m-learning becomes very complex. M-learning implementation and adoption at universities is technically complex given that learning is a composition of learners, instructors, content, and institutions. Tertiary institutions, when implementing m-learning, should also consider the various social and cultural issues, as well as other factors, such as stakeholders, that may affect m-learning implementation. Section 2.6.6 explains the challenges associated with lack of management and/or institutional support.

2.9.7 Slow uptake in developing countries

There are several challenges that could be responsible for the slow uptake of m-learning adoption in developing countries as discussed above. In most developing countries, m-learning in tertiary institutions is described as immature and underdeveloped (Kaliisa, Palmer and Miller 2019). Studies from developing countries are still establishing the factors that influence m-learning adoption in these countries (Iqbal and Bhatti 2016; Al-Adwan, Al-Madadha and Zvirzdinaite 2018; Alsswey and Al-Samarraie 2019), which seems to highlight a lack of information about the key factors driving m-learning in developing countries. A systematic review of m-learning in higher education within Africa between 2010 and 2016 found only 31 empirical studies, with a lack of large-scale studies assessing the effectiveness of m-learning in higher education institutions in the African context. Literature shows that students in higher education institutions in this developing continent are keen to adopt m-learning (Asiimwe and Grönlund 2015; Mtebe and Raisamo 2014; Willemse, Jooste and Bozalek 2019). It is encouraging that, despite the inadequate amount of research on m-learning in Africa, learners are keen to adopt m-learning.

It is evident that many developing countries face a myriad of challenges. However, these challenges are not common to all developing countries. For developing countries, m-learning has to be designed in light of the specific context in order for it to be successful. It is therefore important to investigate the factors that influence m-learning in a specific context and to consider the region-specific challenges and how to overcome these in that context. A diagrammatic summary of the m-learning challenges is shown in Figure 2. 8.

Figure 2.8 Summary of M-learning challenges (section 2.9) (prepared by researcher)

2.10 Pedagogy

Pedagogy involves the theory and practice of teaching. Studies in higher education show two different approaches to teaching in tertiary institutions: teacher-centred or content-oriented, and student-centred or learning-oriented (Kember 1997; Trigwell, Prosser and Waterhouse 1999). Lecturers who see their role as being one of information transmission are likely to depend exclusively upon a unidirectional lecture approach (Kember 1997). Trigwell, Prosser, and Waterhouse (1999) suggest that such lecturers are bound to be teaching students who have a superficial approach to learning. There is a relationship between students' perceptions of their learning environment and their approach to learning, with a deep approach to learning associated with high quality learning (Ramsden 2003). M-learning implementation should therefore take into account the lecturers' teaching practices as well as the learners' perceptions of their learning environments as both of these factors can influence m-learning adoption.

2.10.1 Learning theories

Effective learning has to be grounded in learning theories, which have been covered extensively in Section 2.4.

2.11 Negative aspects of m-learning

Literature discusses at length the potentials and benefits of m-learning, although there is little focus on the actual m-learning environment. Based on the definition of m-learning adopted for this study, that is, learner-centred (section 2.3.3), the m-learning environment involves mobile learners leveraging mobile technologies for knowledge augmentation and acquisition. Some negative aspects of the m-learning environment are explored below.

2.11.1. Mobile devices not suitable for learning

Earlier research indicated that mobile devices, particularly mobile phones, are not designed for educational purposes, making it difficult at times for learners to use these devices to complete tasks set by lecturers (Miangah and Nezarat 2012; Kukulska-Hulme 2005; Stockwell 2008). The difficulties that students could experience when attempting to complete given tasks are partly due to the initial design of the mobile devices and the non-existence of sophisticated mobile phones. Therefore, instructors should choose or adapt the educational resources so that they are compatible with the available mobile devices (Miangah and Nezarat 2012). However, more recent studies have shown that mobile devices are indispensable tools for various learners in different education settings (Khabiri and Bagher Khatibi 2013; Fuller and Joynes 2015; Sánchez-Prieto et al. 2018; Ally and Wark 2018). Some studies still show that mobile devices are not suitable for specific learning activities (Vnoučková and Urbancová 2019; Hao et al. 2019). There is a clear shift, as time progresses and mobile devices become more and more sophisticated, they are becoming more widely accepted as learning tools. With most people using mobile devices daily as hybrid devices with various apps for a wide range of purposes, the capabilities of mobile devices are likely to be improved, so the accessibility of learning materials via mobile devices will become more important. Mobile technologies should not be perceived as tools for content delivery only; hence, consideration should be given to aspects such as collaboration, context learning and self-learning that facilitate knowledge acquisition.

2.11.2 Some students prefer PCs

An earlier experiment demonstrated that learners found that activities took a long time to complete on mobile devices and therefore preferred to PCs to mobile devices (Stockwell 2008). In a different experiment, in which students collected, shared and discussed artefacts to solve tasks, mobile device users paid more attention to course materials (Lan et al. 2012). Furthermore, the mobile device users were more engaged in reflective practice and shared a wide range of information.

In Brunei, many students use smartphones for academic purposes such as accessing online-teaching materials and organise teamwork to solve problems and share knowledge (Anshari et al. 2017). An experiment conducted to investigate the impact of m-learning on a language that compared students listening to activities on mobile devices versus a control group that used computers, showed that listening anxiety decreased and listening comprehension improved for the experimental group (Rahimi and Soleymani 2015). In a small-scale study exploring students' attitudes towards using mobile devices versus desktop computers, findings indicated that a majority of the students preferred using mobile devices for their learning activities (Wong et al. 2015). These preliminary findings were attributed to people using mobile devices to access Internet daily versus PCs, and that most learners who use mobile devices to access the Internet most of the time will be eager to use the same devices as learning tools.

It is likely that some students, if given the choice between using mobile devices and PCs, would prefer PCs because of the larger screens. Some of the barriers to m-learning adoption have to do with the characteristics of the mobile devices themselves. Some aspects of mobile technologies may prevent optimal learning experience, and may include limited battery life, small screen size, the diversity of mobile technologies, and the fact that mobile technologies may distract learners from completing academic tasks (Pachler, Bachmair and Cook 2010; Nikou and Economides 2015; Mehdipour and Zerehkafi 2013). The technical limitations attributed to the physical attributes of mobile devices such as limited battery life, screen size, screen brightness, multiple standards, multiple operating systems, lack of data input capability, number of file/asset formats supported by a specific device and insufficient memory, may make mobile devices unsuitable for learning (Alsaadat 2009; Asiimwe and Grönlund 2015;

Mehdipour and Zerehkafi 2013; Park 2011; Adesope, Olubunmi and McCracken 2007). However, there seems to be a shift in the way mobile devices are perceived, with more learners accepting mobile devices as learning aids. The widespread use of mobile devices, coupled with the increased functionalities and increased use for educational purposes, is likely to overcome the perception that mobile devices are not designed for educational use.

2.11.3 Student discomfort

While mobile technologies facilitate learner initiative and control over the assigned activities, there is a social obligation effect that can also have some negative consequences on learning (Sazalli, Wegerif and Kleine-Staarman 2014). For example, some students were not happy to share their work with a bigger audience on social media, as they felt the pressure of competing with more advanced learners. Another example was that learners felt obliged to respond to notifications sent to their mobile devices, which was uncomfortable for some learners who described it as an intrusion of their personal space. In a different study, some students felt uncomfortable with SMSs which they were encouraged to use when consulting or asking others about assignments (Hilao and Wichadee 2017). Although mobile social learning is generally seen in a positive light, there are indications that some learners feel embarrassed to ask questions on the social platforms (Sazalli, Wegerif and Kleine-Staarman 2014). These students feel that their questions are too simple to be asked in public; instead, they send personal messages to friends rather than share their doubts with the teacher or their group members. Like any other learning aid, it is possible that not everyone will take a liking to it, but as mobile devices continue to be intertwined with daily activities, it is probable that they will become a more dominant learning aid in future.

2.11.4 Interruptions

M-learning interruptions are mostly environment-based. Interruptions may be in the form of attentional distractions, noise and change in temperature, which have the potential to disrupt the engagement of the mobile learner. Interruptions to m-learning could bring a halt to the learning process as a result of a noisy background or receiving a phone call or notification while carrying out a learning activity (Bhandari and Chang 2017). The interruptions place an extra cognitive load on the learner who needs to recover from the environmental interruptions (Deegan 2015, 2013). Too many push notifications cause interruptions and can induce stress

(Yoon et al. 2014). While literature praises the flexibility offered by m-learning, (section 2.8.1.8), it has been argued that as the learner moves from one context to another, there is a greater risk of interruption, distraction and reduced concentration (Terras and Ramsay 2012). The success of m-learning may lie in carefully designing m-learning activities and taking into consideration the correct balance of sending just enough notifications and the learners managing their return to learning activities after environmental interruptions.

2.11.5 Individual differences

There are suggestions that the individual differences of learners must be considered when adopting m-learning. Individual differences matter in m-learning (Terras and Ramsay 2012; Talan 2020). Terras and Ramsay (2012) suggest that despite learners having being exposed to ICT, having ICT skills and using the technology regularly, it should not be assumed that: (1) learners have specific common expectations regarding the educational use of social networking applications; and (2) learners have the pre-requisite skills to fully utilise the educational potential offered by technological developments. Terras and Ramsay (2012) further argue that the student population is heterogeneous with differences in, for example, age, socio-economic factors and gender which influence the extent to which they engage with a specific technology. More recently, Terras and Ramsay (2018) claimed that individual learner skills and preferences will become more important when m-learning takes advantage of the opportunities offered by Web 3.0. They conclude that understanding the psychosocial profiles of mobile learners will be essential to providing fluid and effective personalised learning. In communities where m-learning is in its infancy, it is important to have a full appreciation of the different learners and how these differences can be accommodated in m-learning. Differences may pertain to use and exposure to ICT and learners' expectations of m-learning. M-learning planning that considers these differences is likely to result in successful m-learning implementation.

2.11.6 Ethics

Ethical concerns have arisen in m-learning. Ethical issues may arise from m-learning research and from the actual online activities related to m-learning (Traxler 2005). Ethical issues regarding informed consent have to be considered in m-learning, with suggestions that research ethics involved in exploring informal on-line behaviour are inappropriate and immature (Dyson et al. 2013; Sharples 2009; Traxler and Vosloo 2014). Only participants who understand the nature of their participation can legally grant consent; however, with m-learning, when there is no face-to-face contact, it may be difficult to establish whether the consent is truly informed (Traxler 2005). Some challenges to ethical m-learning are because ethical concepts are complicated and for most people it will be easier to lapse into ethical relativism (Farrow 2011). The challenges of ethics in m-learning are further compounded by other aspects such as physical and online cultural divides.

Researchers, through their interventions, may cause harm in different ways such as oppressive practice, embarrassment, shame and bias (Traxler and Vosloo 2014). Some key ethical concerns pertaining to classroom-based m-learning are cyber-bullying, potential access to materials intended for a limited school based audience, and the sharing of digital content that includes student data for professional purposes (Aubusson, Schuck and Burden 2009). Ethical concerns in m-learning are two-fold stemming from research work and how it can affect the mobile learners. M-learning activities, which include research, should take an ethical approach to ensure that no harm is done to research participants and the mobile learners. Currently, there seems to be little literature on the ethical implications of m-learning. A diagrammatic summary of the negative aspects of m-learning is shown in Figure 2.9.

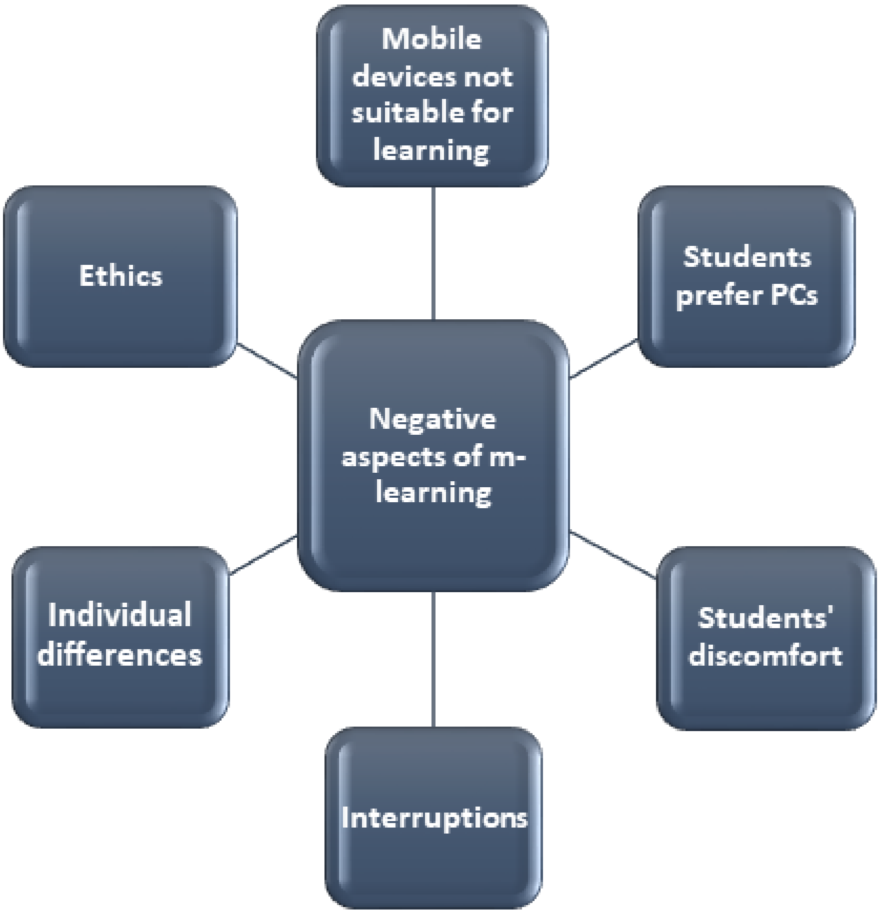


Figure 2.9. Summary of negative aspects of m-learning (section 2.10) (prepared by researcher)

2.12 Review of current m-learning frameworks and models

There are several m-learning frameworks in literature. However, the most relevant models and frameworks were selected to address the research aims and objectives. A summary of the key characteristics of each m-learning model is given at the end of the discussion of each model. The review starts by examining in chronological order six mobile learning frameworks from developing countries and section 2.12.7 discusses frameworks from developed countries.

2.12.1 A proposed theoretical model for m-Learning adoption in developing countries

The model is underpinned by a traditional learning environment supported by necessary standards and policies (Barker, Krull and Mallinson 2005) Figure 2. 10. The model has a communication infrastructure with wireless access points to enable communication between mobile devices. The mobile devices in this model can be used for academic support and enables learner-to-learner communication as well as learner-to-teacher communication. Other important features of the model are the critical success factors and stakeholders which include learners, their parents, teachers, system designers, device vendors, and support staff. The model is applicable to both developed and developing countries. While most developed countries may have the necessary policies and standards in place, the same cannot be said for most of the developing countries.

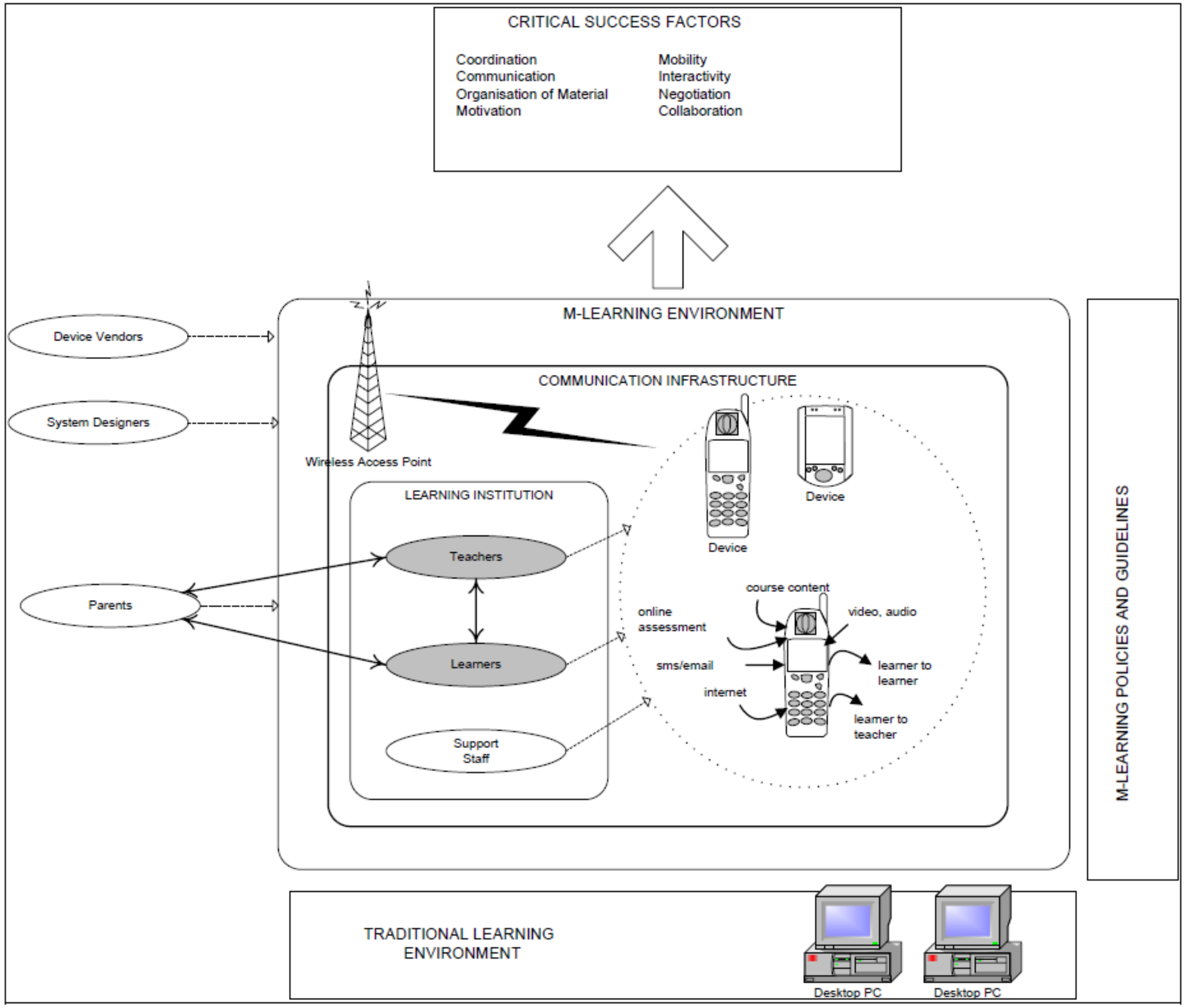


Figure 2.10. A Proposed Theoretical Model for M-Learning Adoption in Developing Countries (Barker, Krull and Mallinson 2005)

A summary of this framework is shown in Table 2. 4.

Table 2. 4 Summary A Proposed Theoretical Model for M-Learning Adoption in Developing Countries (Barker, Krull and Mallinson 2005)

Stakeholders	Challenges to m-learning	Factors influencing m-learning adoption	M-learning characteristics

2.12.2 Low-key m-learning model

The low-key m-learning model for developing countries (Masters 2005), focuses on administration functions (Figure 2. 11). Masters (2005) concedes the model is not remarkable when compared to the way that developed countries are making strides in m-learning. The model demonstrates a set of principles suitable for the introduction of m-learning into the third-world environment or institutions that are taking tentative steps towards m-learning. The model aims to meet the philosophical and psychological goals of adapting current mindsets of staff and students to the use of mobile communication in teaching.

The theoretical framework is drawn from the three elements of pedagogy, mobility and ubiquity, but is strongly driven by the technology. There is criticism of the model being driven by technology rather than by educational needs. The criticism has been quelled by the creators on the basis that educational needs are vast, and the model is designed for relatively immature technological environments.

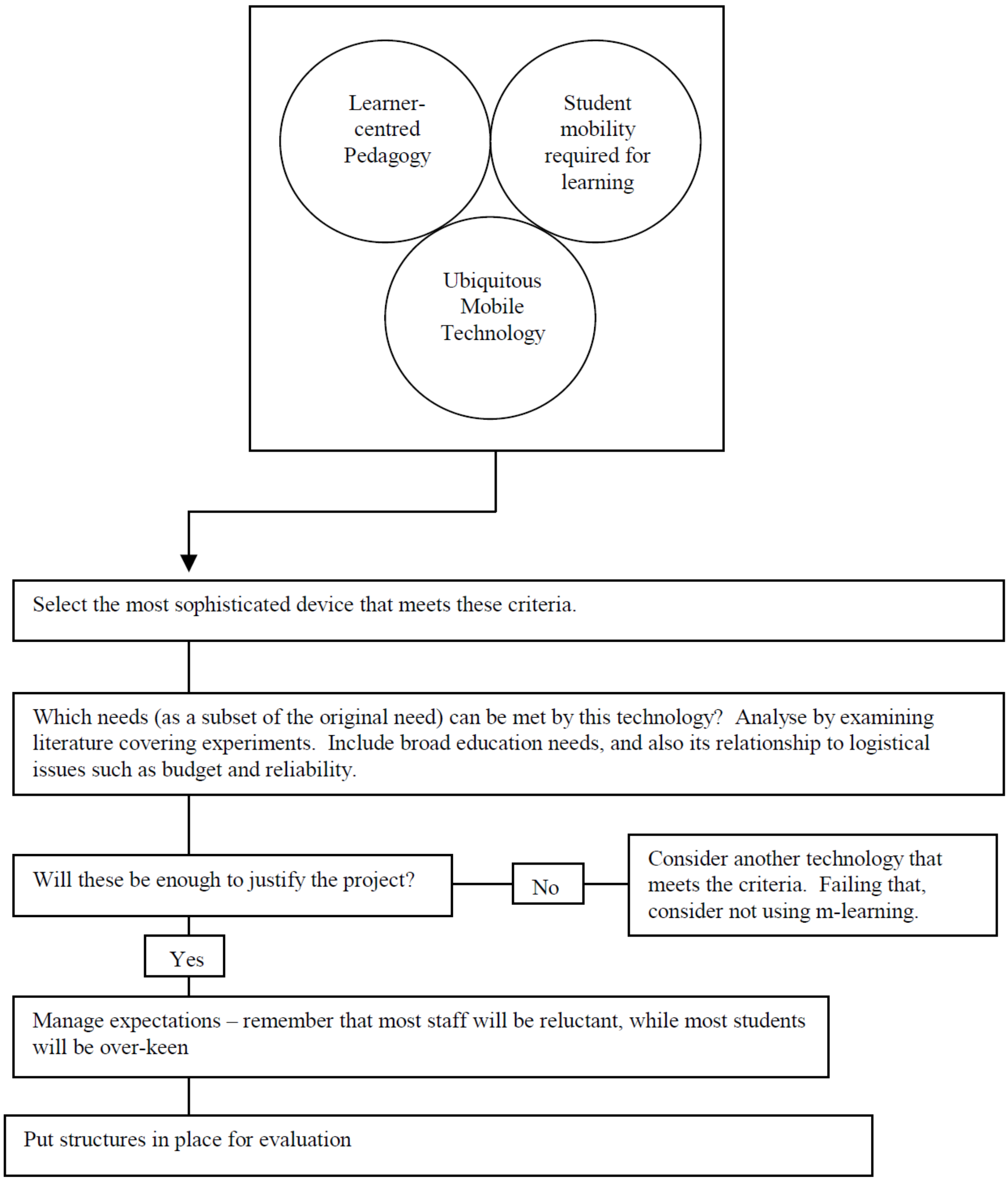


Figure 2.11. Low key m-learning model (Masters 2005)

A summary of this framework is shown in Table 2. 5.

Table 2. 5 A summary of low key m-learning model (Masters 2005)

Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.3 Framework for designing effective mobile learning materials

The m-learning framework is based on the issues that obstruct the effective design of mobile learning materials (Adesope, Olubunmi and McCracken 2007), Figure 2. 12. The creators identify three major challenges to effective m-learning: inadequate infrastructure, lack of implementation grounded in a learning theory, and cost. Infrastructure is the biggest challenge to m-learning implementation in Africa (Adesope, Olubunmi and McCracken 2007). The infrastructural issues that need to be addressed are the unreliable electricity supplies and poor Internet connections. The lack of a sound infrastructural basis translates to high costs of m-learning implementation, especially in developing countries. Developers of this framework acknowledge that, in developed countries, some learning theories facilitate m-learning, citing an example of empirical and theoretical support for the usefulness of collaborative learning in literature. This is in sharp contrast to the very large classes in some developing countries with none or minimal subgroup interaction and collaborative learning.

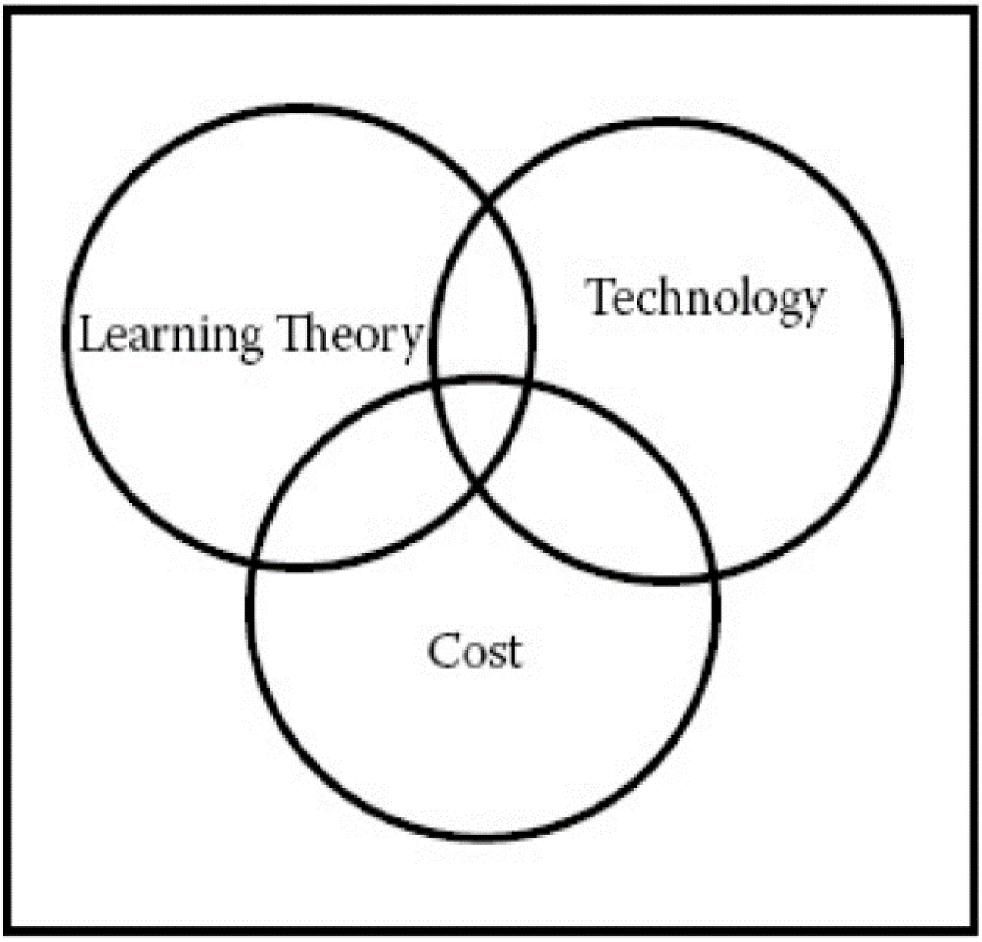


Figure 2.12. Framework for designing effective mobile learning materials (Adesope, Olubunmi and McCracken 2007)

A summary of features aspects of this framework is shown in Table 2. 6.

Table 2. 6 A summary of a framework for designing effective mobile learning materials (Adesope, Olubunmi and McCracken 2007)

Factors influencing m-learning adoption	M-learning challenges	Pedagogy

2.12.4 A pragmatic framework for integrating ICT into education in South Africa

The framework proposed by (Ford and Botha 2010) is grounded in the local context of a developing country with the typical problems and issues experienced in such contexts Figure

2.13. It is an environment where affordability, accessibility, limited electricity supply and lack of infrastructure generally lead to poor ICT literacy. For technology to be effective, it must be supported by learning theories and pedagogical principles (Ford and Botha 2010). The proposed framework takes into consideration pedagogical practice, stating that it is important for instructors to be comfortable with the technology if they are to use it for teaching and learning.

The design process faces the challenge of integrating the various technological and pedagogical perspectives and learning processes within the developing country context. The creators of this framework suggest that from a context perspective, the solution should be affordable, accessible, not be too dependent on the electricity supply and specialist skills in order to operate. This practical framework uses a social media tool, Mxit, and has provision for other mobile technology applications and services. Teachers can use various devices to manage content, assessment, and the learning process. There are a variety of learning activities, and multiple learning models that can be utilised in the learning process.

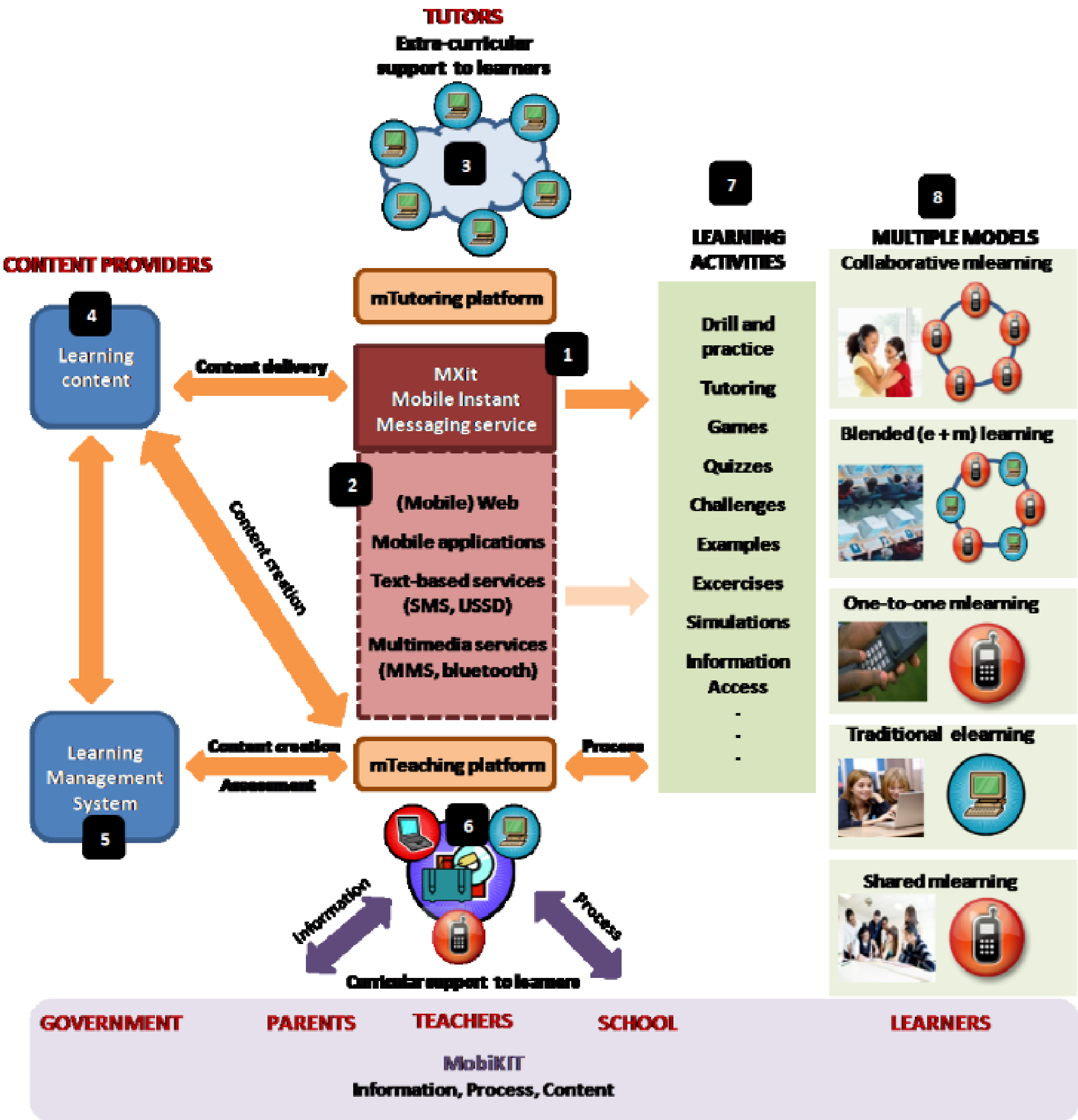


Figure 2.13. A Pragmatic Framework for Integrating ICT into Education in South Africa (Ford and Botha 2010)

The features of this framework are shown in Table 2. 7.

Table 2. 7 Summary of a Pragmatic Framework for Integrating ICT into Education in South Africa (Ford and Botha 2010)

Stakeholders	M-learning challenges	Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.5 Integrating m-learning with e-learning

The framework proposed by (Wains and Mahmood 2008) and shown in Figure 2.14, can be divided into three parts: e-learning environment which is supported by the traditional learning environment, m-learning environment and distance learning institution. The E-learning environment relates to the way that distance learners obtain academic and administrative support. The E-learning environment consists of desktop PCs, television and radio sets, which students use to access the course material. Learners browse the course website, communicate with tutors using discussion forums, view their examination results, and obtain administrative information.

The m-learning environment makes use of mobile phones because the technology is cheap and widespread. Learners can use mobile devices to access the M-Learning Management System (M-LMS). The presentation of content suitable for m-learning is a major challenge of the system according to the creators of this framework. The system must allow students to participate in a course regardless of the mobile device they use for accessing the information. The creators of the framework assert that m-learning is utilised for some specific contents such as language learning courses or information technology courses which are innately modular, thus making it easy to present the contents in smaller chunks.

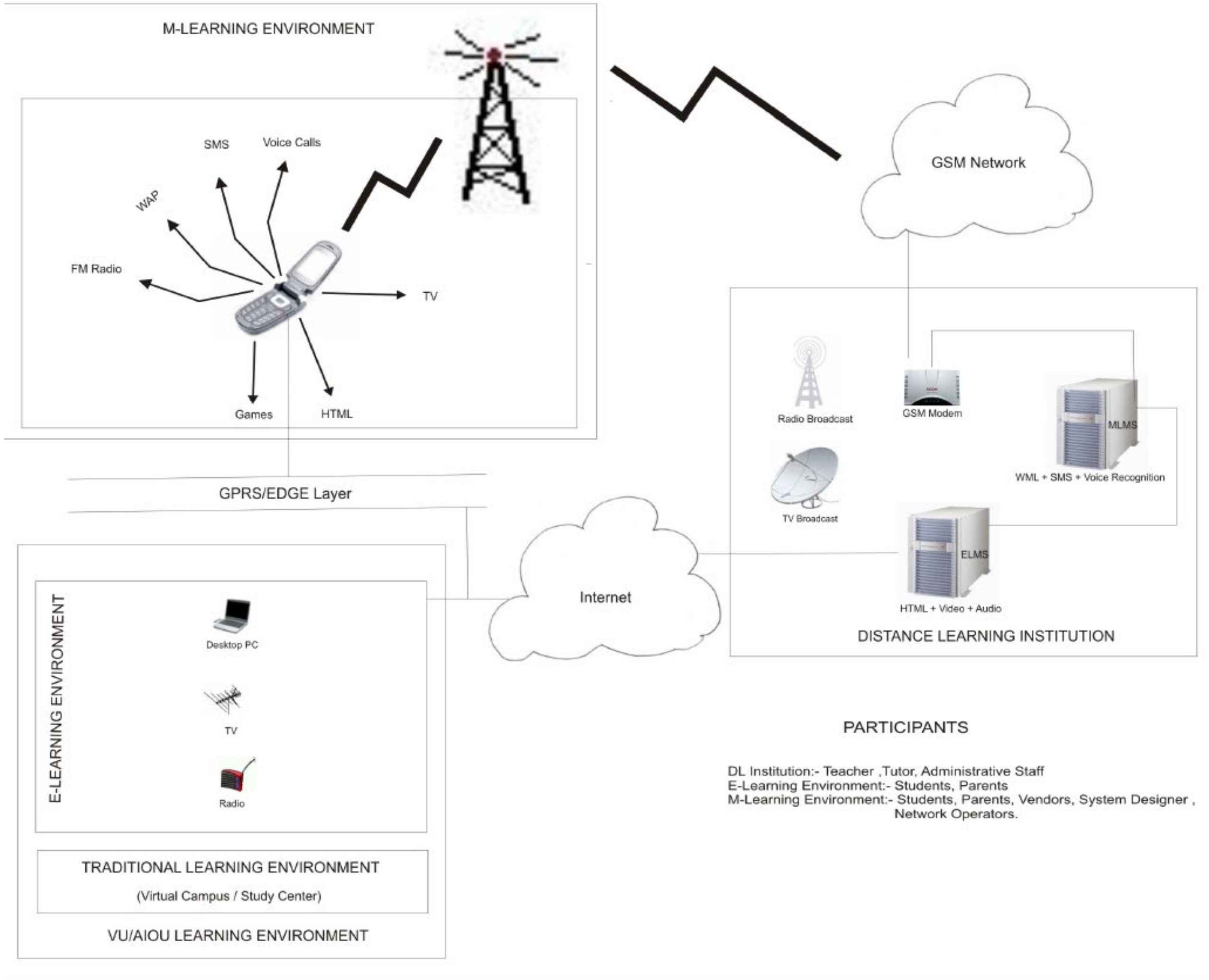


Figure 2.14. Integrating M-learning with E-learning (Wains and Mahmood 2008)

A summary of the features of this framework are shown in Table 2. 8.

Table 2. 8 A summary of Integrating M-learning with E-learning (Wains and Mahmood 2008)

Factors influencing m-learning adoption	M-learning characteristics

2.12.6 Proposed m-learning framework

The m-learning framework proposed by (Ahmed and Ghareb 2017) for m-learning in higher education has three main components: (1) technical, (2) cultural and (3) theoretical, as shown in Figure 2.15. The technical aspect encompasses the technical challenges such as device issues, hardware and software issues, framework and system issues, accessibility, usability, implementation, and connectivity issues.

The cultural aspect looks at what drives the learning in an environment with mobile technologies. This covers pedagogy training focussing on learning content, formal and informal learning. The theoretical aspect covers some learning theories namely behaviourist learning, constructive learning, and collaborative learning. It also includes preparing learners effectively for the use of mobile technologies in learning.

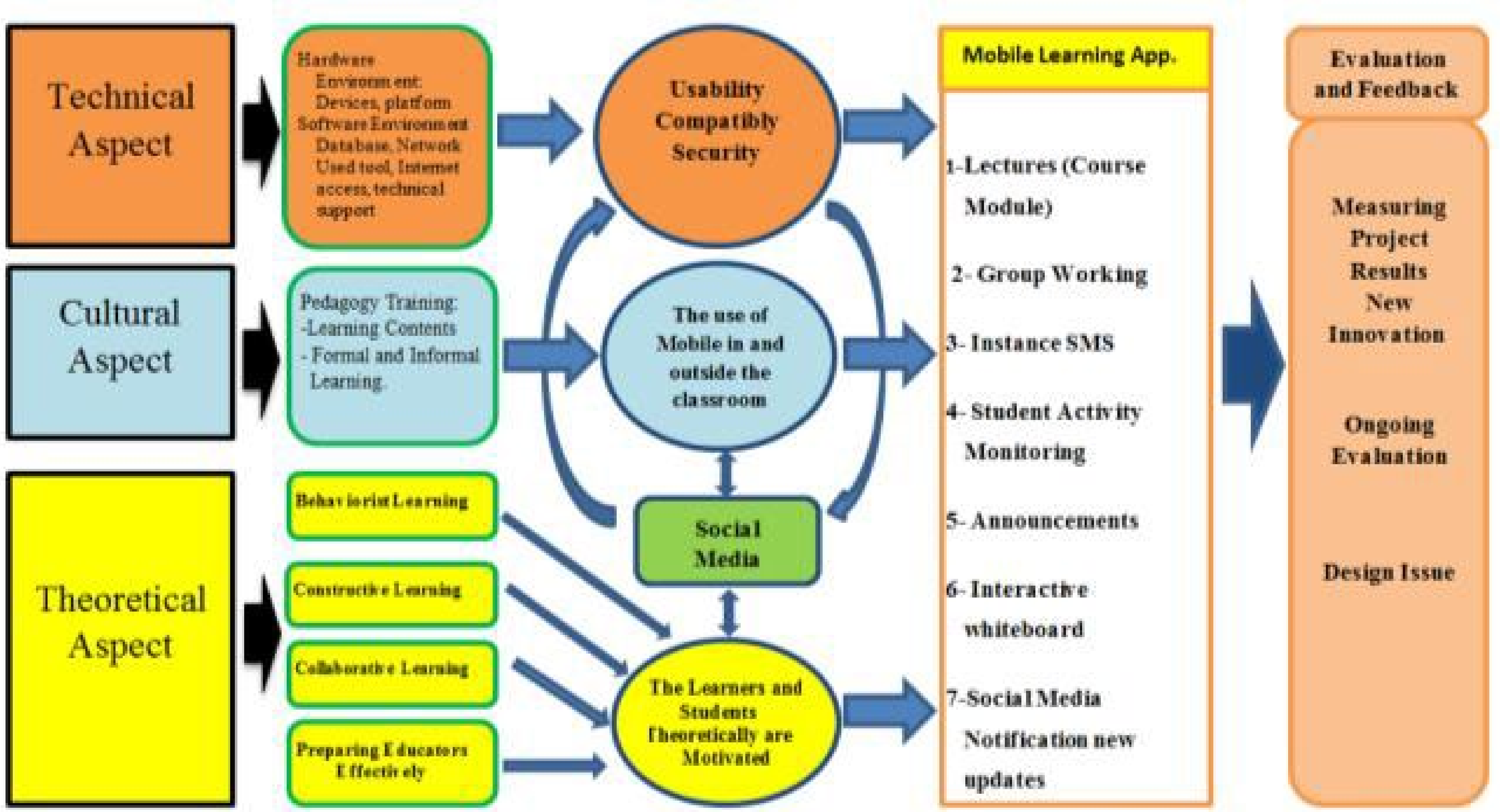


Figure 2.15. M-learning proposed framework (Ahmed and Ghareb 2017)

A summary of the aspects of this framework is shown in Table 2. 9.

Table 2. 9 A summary of M-learning proposed framework (Ahmed and Ghareb 2017)

M-learning challenges	Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.7 Technological model for implementation of m-learning in higher education

The framework proposed by (Tuparov, Al-Sabri and Tuparova 2019) Figure 2. 16, is a modification of the FRAME model by Koole (2009) discussed in Section 2.10.12. The framework is focussed on technological issues of m-learning implementation in Yemen. In this framework, the device aspect discussed by Koole (2009) is replaced with the technological infrastructure aspect. Some elements of the technological aspect are the end-user devices, learning content format and the communication networks.

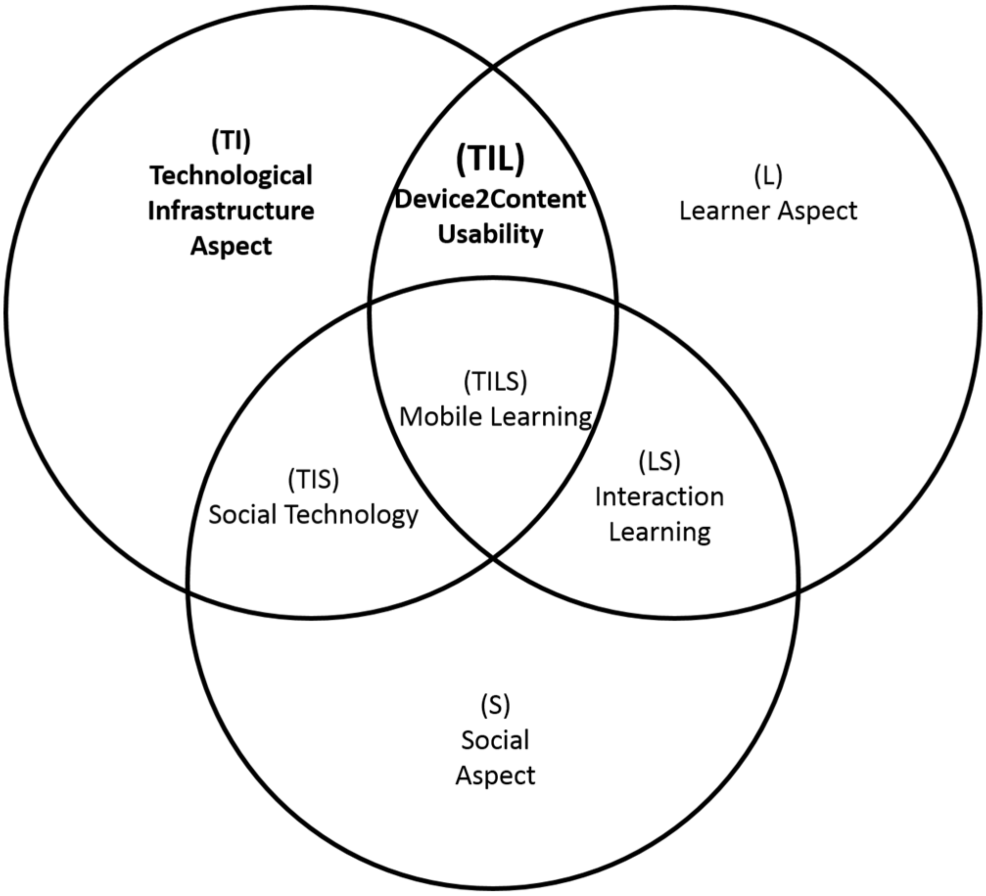


Figure 2.16. General model for m-learning implementation adapted from (Koole 2009) (Tuparov, Al-Sabri and Tuparova 2019)

A summary of aspects of the framework is given in Table 2. 10.

Table 2. 10 A summary of General model for m-learning implementation adapted from Koole (2009) (Tuparov, Al-Sabri and Tuparova 2019)

M-learning challenges	Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

M-learning Frameworks from developed countries (in chronological order) are discussed from section 2.12.8 to 2.12.20.

2.12.8 A framework to analyse technology-mediated mobile learning

The framework proposed by (Sharples, Taylor and Vavoula 2005) shown in Figure 2.17 was explicitly designed to structure and analyse m-learning. It has its roots in the activity theory analysing learning as a cultural-historical activity system, mediated by tools that both constrain and support the learners in their goals of transforming their knowledge and skills. The model can be separated into two layers: semiotic and technological.

The upper part of the triangle in Figure 2.17 contains three standard factors: the learner [subject], the learning goal [object] and the tools that are used to mediate the learning goals for the learner. The tools can be the instructor, a book, a text, a learning-video or an e-learning-module. The model extends the standard factors on the baseline of the triangle by included three influencing factors: context, control and communication. Control of the learning may rest on the (1) instructor, (2) among learners, or (3) between learners and the technology. The creators of this framework note that context has different meanings for different theorists and that context embraces multiple communities of people and interactive technology. While technology offers other opportunities of communication, the creators of this framework note that technology can create tension in communication if not used appropriately.

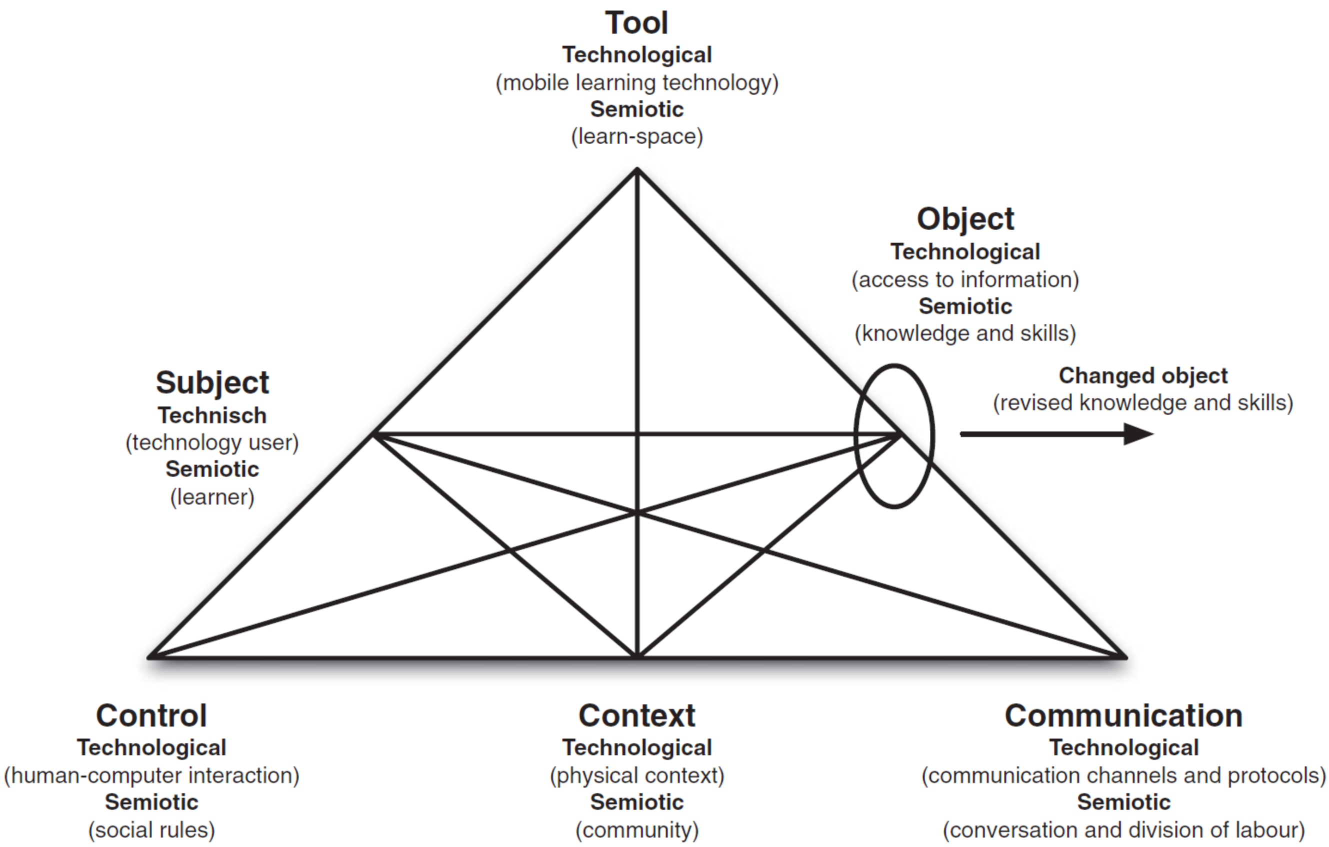


Figure 2. 17 A Framework to Analyse Technology-mediated Mobile Learning (Sharples, Taylor and Vavoula 2005)

The features of this framework are shown in Table 2.11.

M-learning characteristics	Pedagogy

Table 2. 11 A summary of A Framework to Analyse Technology-mediated Mobile Learning (Sharples, Taylor and Vavoula 2005)

2.12.9 A Framework for M-learning design requirements

The conceptual framework proposed by (Parsons, Ryu and Cranshaw 2006) (Figure 2.18) for designing materials for m-learning has four design requirements: generic mobile environment issues, learning contexts, learning experiences, and learning objectives. In the generic mobile environment, the most important aspect is mobility. In this framework, mobility is conceptualised in different ways: mobility of the user, mobility of the device and mobility of the services which emphasises that each user employs his/her mobile device in a unique way. The mobile environment considers the constraints of mobile devices such as smaller screens, limited battery life and poor input methods. Creators review the contextual features used in understanding m-learning from the situational context made up of identity, learner, activity, and collaboration dimensions. The environmental context is made up of spatio-temporal (time and/location) awareness, and facility dimensions which cover the use of public network carriers and innovative technologies.

Under learning experiences, the focus of the design is on the user's learning experience taking into consideration the user's experience goals. The creators of the framework suggest that learning experience and objectives are shaped by: (1) organised content delivery, (2) outcome and feedback that measure the goals and objectives,(3) goals and objectives that help keep the learner engaged (4) the narrative factor which helps learners reflect on what they have learned, (5) conflict, competition, challenge, and opposition are the problems the learners are trying to solve, either individually or collectively and (6) social interactions which establish collective learning.

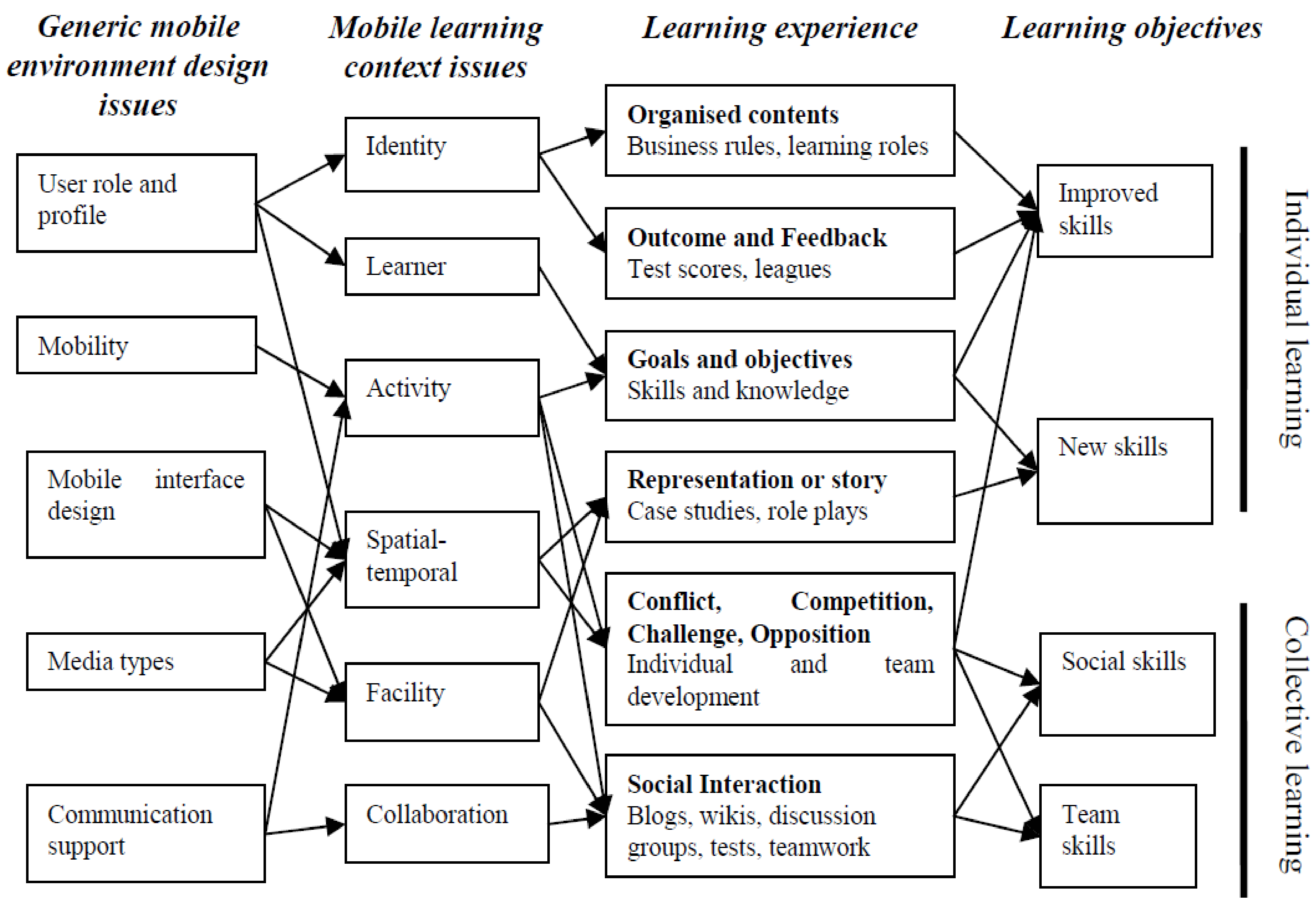


Figure 2.18. A Framework for M-learning design requirements (Parsons, Ryu and Cranshaw 2006)

The features of this framework are summarised in Table 2. 12.

Table 2. 12 Summary of a framework for m-learning design requirements (Parsons, Ryu and Cranshaw 2006)

Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.10 A mobile-learning Framework

Motiwalla (2007) proposes an m-learning framework made up of two levels of research and analysis comprising: (1) mobile connectivity and (2) e-learning (Figure 2.19). Mobile connectivity focusses on technology and applications used by commercial institutions to extend electronic commerce, while e-learning focusses on the use of Internet and other ICT in education. Mobile connectivity allows learners to access learning material while in transit. The proposed framework integrates the ideas from mobile connectivity and e-learning into application requirements for m-learning. The framework is based on the mobile connectivity aspects of personalised and collaborative content delivery, suggesting that content delivery can be more effective when used with a combination of push and pull mechanisms. From e-learning research, the framework draws on pedagogical approaches that support constructive learning that have successfully worked in education.

	Personalized Content	**Collaborative Content**	
PUSH Mechanism	*Pedagogical Agents & Mentors*	*Communication Aids*	*SMS, IM, Alerts, Scheduling Calendars*
PULL Mechanism	*System Tools & Resources*	*Simulated Classrooms*	*WML websites, Discussion Boards & Chat Forums*
	Alerts, Scheduling Calendars, WML websites	*SMS, IM, Discussion Boards & Chat Forums*	**M-learning Applications**

Figure 2.19. A mobile-learning framework (Motiwalla 2007)

In summary this framework considers the aspects in Table 2.13.

Table 2. 13 A summary of a mobile-learning framework (Motiwalla 2007)

Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.11 Design framework for mobile learning

Liu et al. (2008) developed a framework based on the reflections and results of activity-oriented design of the Nokia Mobiledu project (Figure 2. 20). The design of this mobile framework comprises four elements: (1) mobile learning activity design, (2) requirement and constraints analysis, (3) mobile learning scenario design, and (4) mobile learning technology environment design.

The mobile learning activity design can be regarded as the interactions between the learners and the m-learning context mediated by wireless mobile technology tools and resources. The requirement and constraints analysis have two levels of requirement analysis: the general and concrete levels. The general level seeks to address the common features of m-learning, the current state of ICT in education, the potential users and existing mobile learning applications as well as motivations and expectations. The concrete level investigates the users and the users' learning environment. It includes potential users' skills, experiences, attitudes, use pattern, motivations, learning characteristics and environment and influencing factors.

The m-learning scenario design describes how learners with particular characteristics in particular settings carry out various activities to achieve their learning goals. The mobile learning technology environment, the 'Environment', comprises elements such as database, platforms, networks and other technological aspects of mobile learning that support and sustain the m-learning activities. The creators of the framework suggest that learners could benefit from four support areas to increase their confidence and competencies. The four areas are: (1) consulting services, (2) blended learning services, (3) training and (4) community support services.

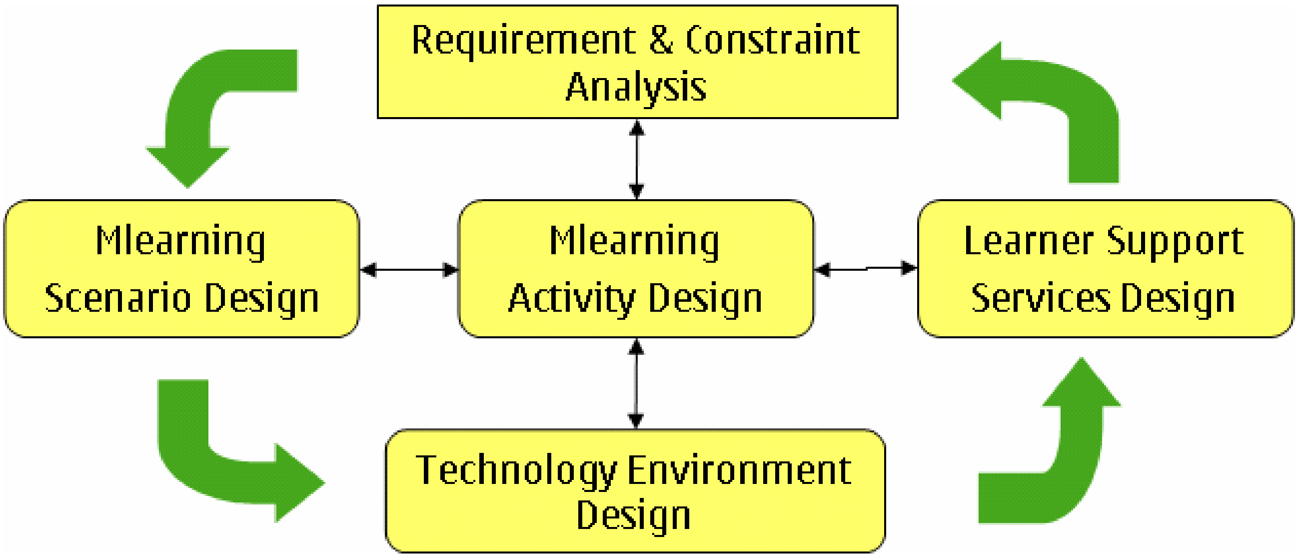


Figure 2.20. Design framework for mobile learning (Liu et al. 2008)

The features of this framework are shown in Table 2.14.

Table 2. 14 Summary of design framework for mobile learning (Liu et al. 2008)

Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.12 The framework for the rational analysis of mobile education (FRAME)

In the framework for the rational analysis of mobile education (FRAME) (Koole 2009) (Figure 2.21), the model contains concepts from activity theory. In this model, the role of technology goes beyond being an artefact of "cultural-historic" development; rather, the mobile device is perceived as an active component on an equal footing with learning and social processes. The FRAME model is represented by a Venn diagram in which three aspects intersect: the device (D), learner (L), and social (S); the intersections where two circles overlap contain common attributes.

The interaction learning intersection (LS) represents a synthesis of learning and instructional theories, with an emphasis on social constructivism. The device usability intersection (DL) contains elements that belong to both the device (D) and learner (L) aspects which relates the features of mobile devices to cognitive tasks related to the manipulation and storage of information. The social technology intersection (DS) describes how mobile devices enable communication and collaboration amongst multiple individuals and systems. All three aspects overlap at the primary intersection (DLS) in the centre of the Venn diagram. Theoretically, the primary intersection where all three aspects converge, is an ideal mobile learning situation.

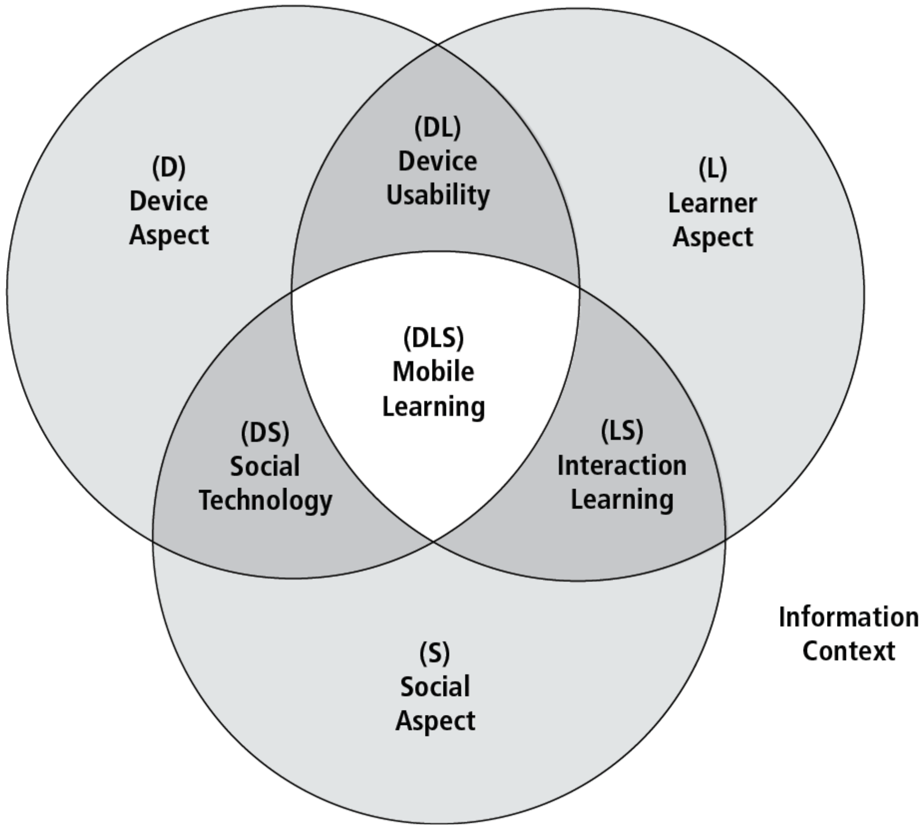


Figure 2.21. Framework for the Rational Analysis of Mobile Education (FRAME) (Koole 2009)

The features of this framework are summarised in Table 2.15.

Table 2. 15 Summary of the framework for the rational analysis of mobile education (FRAME) (Koole 2009)

Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.13 The conceptual framework of ubiquitous knowledge construction

Peng et al. (2009), suggest a theory-based framework which is organised in a hierarchical manner with the m-learning infrastructure at the bottom (Figure 2.22). The m-learning infrastructure is based on a mobile learner who participates in collaborative activities. The tools of m-learning consist of wireless networks and mobile devices. The framework considers relevant issues associated with mobile learners which include classroom management issues, educational digital divides and the need to establish partnerships for pedagogically sound educational tools.

The next level in the hierarchy addresses pedagogical methods. In this framework, m-learning is based on constructivism and life-long learning. At the apex of the hierarchy triangle is the vision for future learning, which investigates ubiquitous knowledge construction.

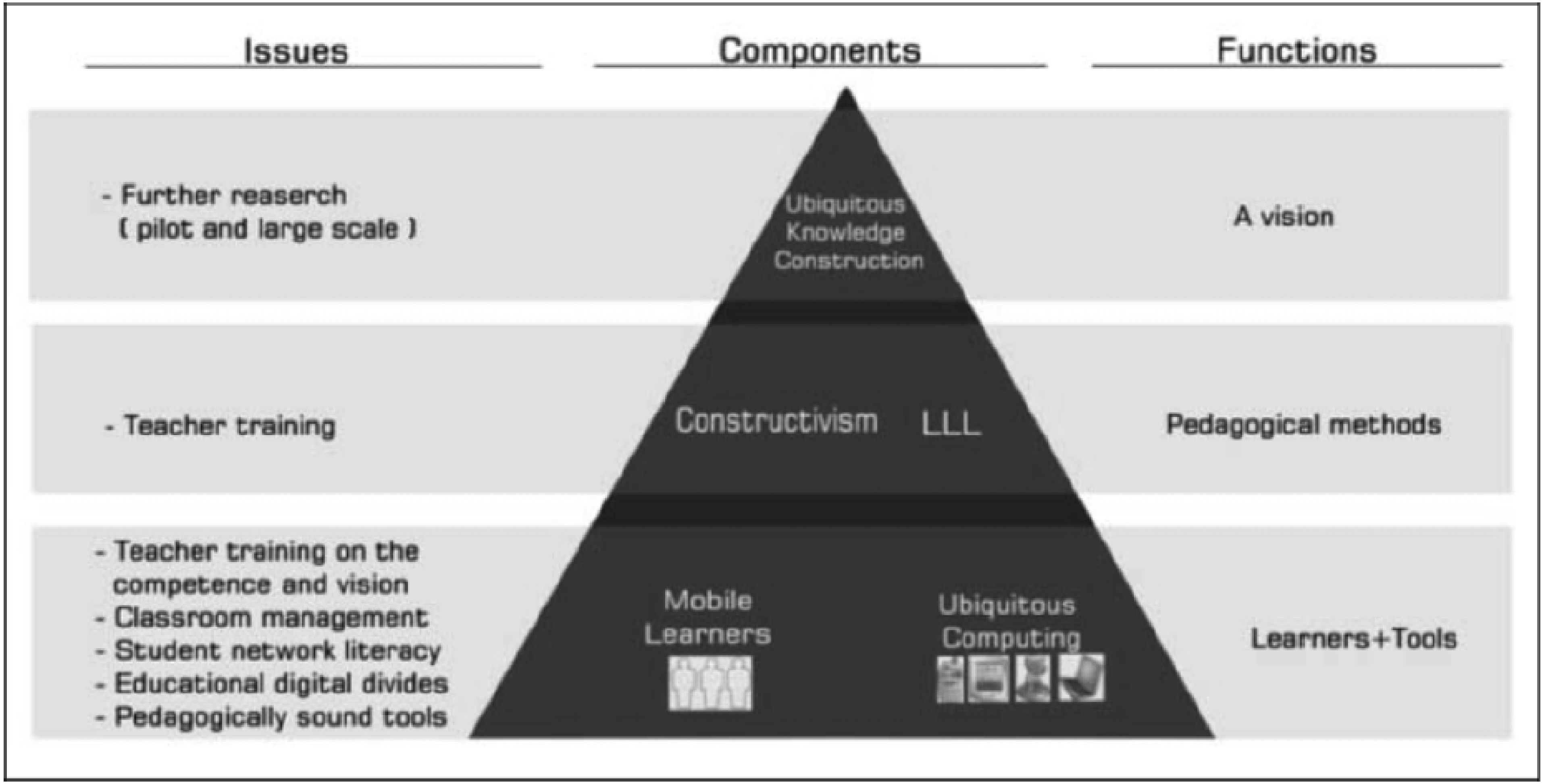


Figure 2.22. The conceptual framework of ubiquitous knowledge construction (Peng et al. 2009)

The elements of this framework are summarised in Table 2. 16.

Table 2. 16 Summary of the conceptual framework of ubiquitous knowledge construction (Peng et al. 2009)

Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.14 A framework for mobile learning design requirements for lifelong learning

The framework for lifelong learning (Nordin 2010) (Figure 2. 23), is largely based on the model proposed by Parsons, Ryu, and Cranshaw (2006). The key elements of both models are the same, with the later model having adjustments to accommodate the purposes of lifelong learning.

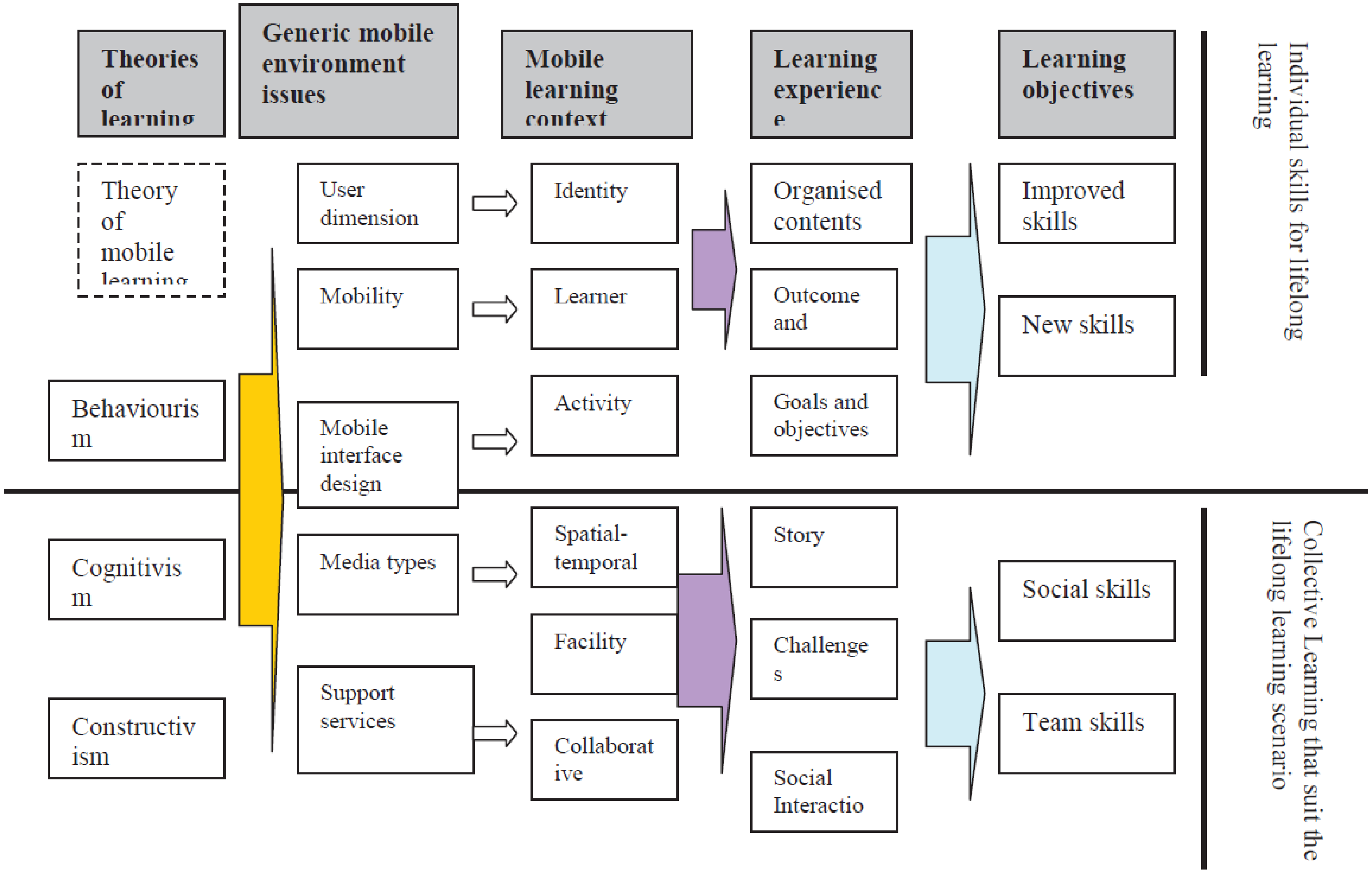


Figure 2.23. A framework for mobile learning design requirements for lifelong learning (Nordin 2010)

Table 2.17 summarises the features of this model.

Table 2. 17 Summary of a framework for mobile learning design requirements for lifelong learning (Nordin 2010)

Factors influencing m-learning adoption	M-learning characteristics	Pedagogy

2.12.15 Four types of mobile learning: A pedagogical framework

Park (2011) adapts the transactional distance (TD) theory and implements it as a relevant theoretical framework for mobile learning in distance education (Figure 2.24). Park (2011) moves from the definition of transactional distance that states that (TD) is a psychological gap between instructor and learner. He asserts that developments in information and communication technology structures of learning are now constructed not only by the instructor, but also by collective learners, and dialogue is also formed not only between the instructor and learners, but also among the learners themselves.

The framework suggested by Park (2011) comprises several elements of activity theory. The framework has dimensions that reflect the characteristics of mobile technologies that support both the individual and social aspects of learning. The individualized and socialized activities are mediated by communication technology.

With mediation at the centre of the framework, individualised activity indicates a method whereby a learner is isolated from communicating with other students, while the socialised activity indicates a form where students collaborate, share ideas and build knowledge. The conceptual framework was produced based on high versus low transactional distance and individualized versus socialized activity. The four types of mobile learning generated in the context of distance education include: (1) high transactional distance socialized m-learning, (2) high transactional distance individualized m-learning, (3) low transactional distance socialized m-learning, and (4) low transactional distance individualized m-learning.

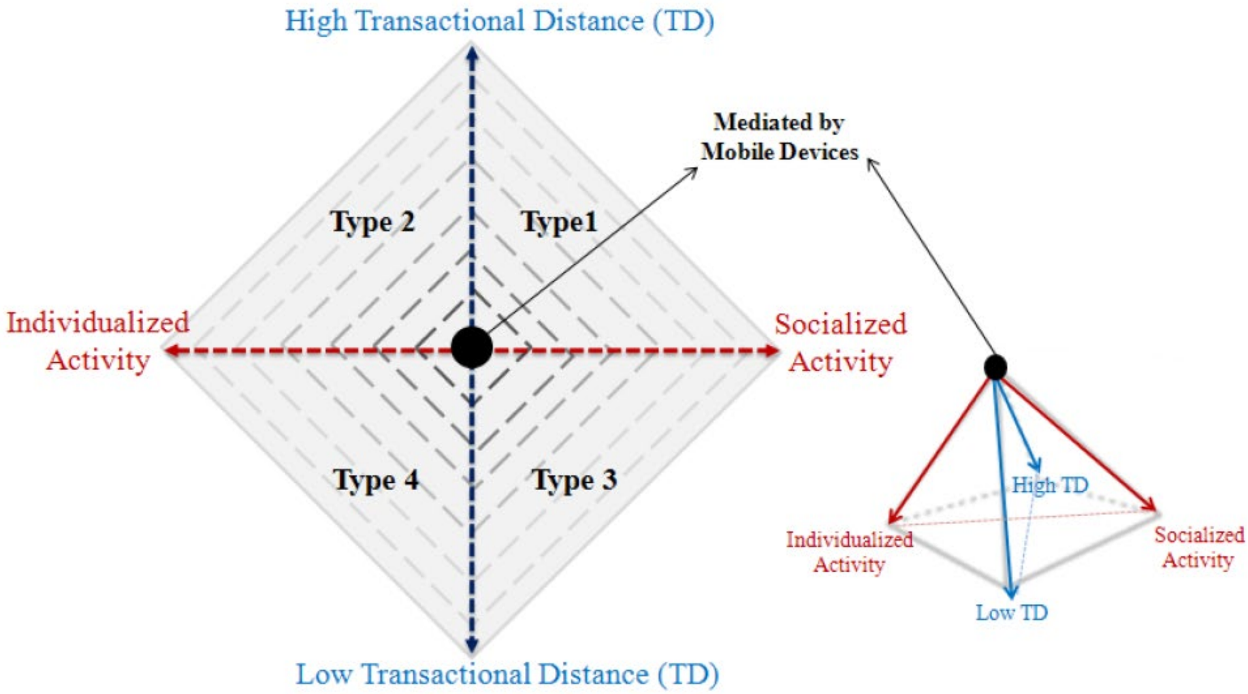


Figure 2.24. Four types of mobile learning: A pedagogical framework (Park 2011)

The features of this framework are shown in Table 2.18.

Table 2. 18 Summary of four types of mobile learning: A pedagogical framework (Park 2011)

M-learning characteristics	Pedagogy

2.12.16 M-learning Framework with three distinctive characteristics

Kearney et al. (2012) propose a m-learning framework with three distinctive characteristics personalisation, collaboration and authenticity (Figure 2.25). These three characteristics each have two sub-scales. The creators of the framework suggest that personalisation is key to m-learning based on the motivational theory and the socio-cultural theory. They claim that key features associated with personalisation include customisation, learner choice, agency and self-regulation. In the framework, it is suggested that m-learning occurrences potentially involve levels of “task and process” authenticity when learners participate in contextual tasks. Collaboration gives mobile learners the opportunity to make rich connections with other people and with other resources mediated by mobile technologies.

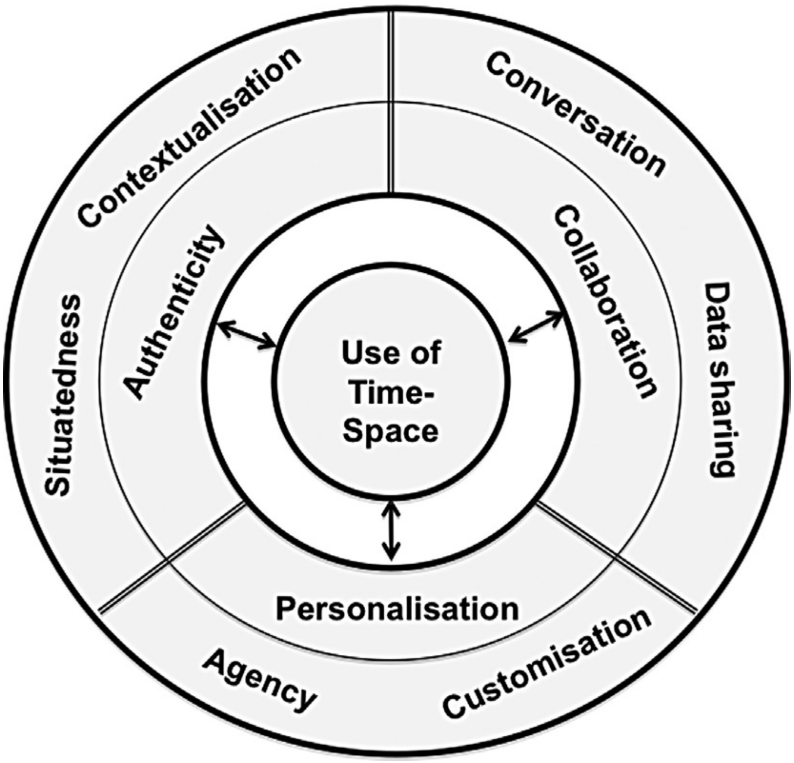


Figure 2.25. M-learning Framework with three distinctive characteristics (Kearney et al. 2012)

Table 2. 19 summarises the features of this framework.

Table 2. 19 Summary of the m-learning framework with three distinctive characteristics (Kearney et al. 2012)

M-learning characteristics	Pedagogy

2.12.17 Mobile Learning development and Evaluation Framework for a Performance based Environment

The framework proposed by Mahazir et al. (2013) considers development and evaluation. The development is based on the ADDIE model whose five main stages are analysis, design, development, implementation, and evaluation (Figure 2. 26). The key model requirements are skills in determining content, the authoring program and a systematic instructional design.

The analysis stage involves determining appropriate learning strategies and learning styles for the students and ensuring students are ready to use mobile applications. The design phase involves designing the navigation process and menus for the prototype. It also includes designing appropriate activities and learning objects for the students. This followed by developing what was designed. The model applies behaviourist, cognitive, and constructivist theories. Implementation enables the researchers to examine the usability, reliability, functionality, and efficiency of the prototype. The evaluation of the framework is based on a quasi-experimental design.

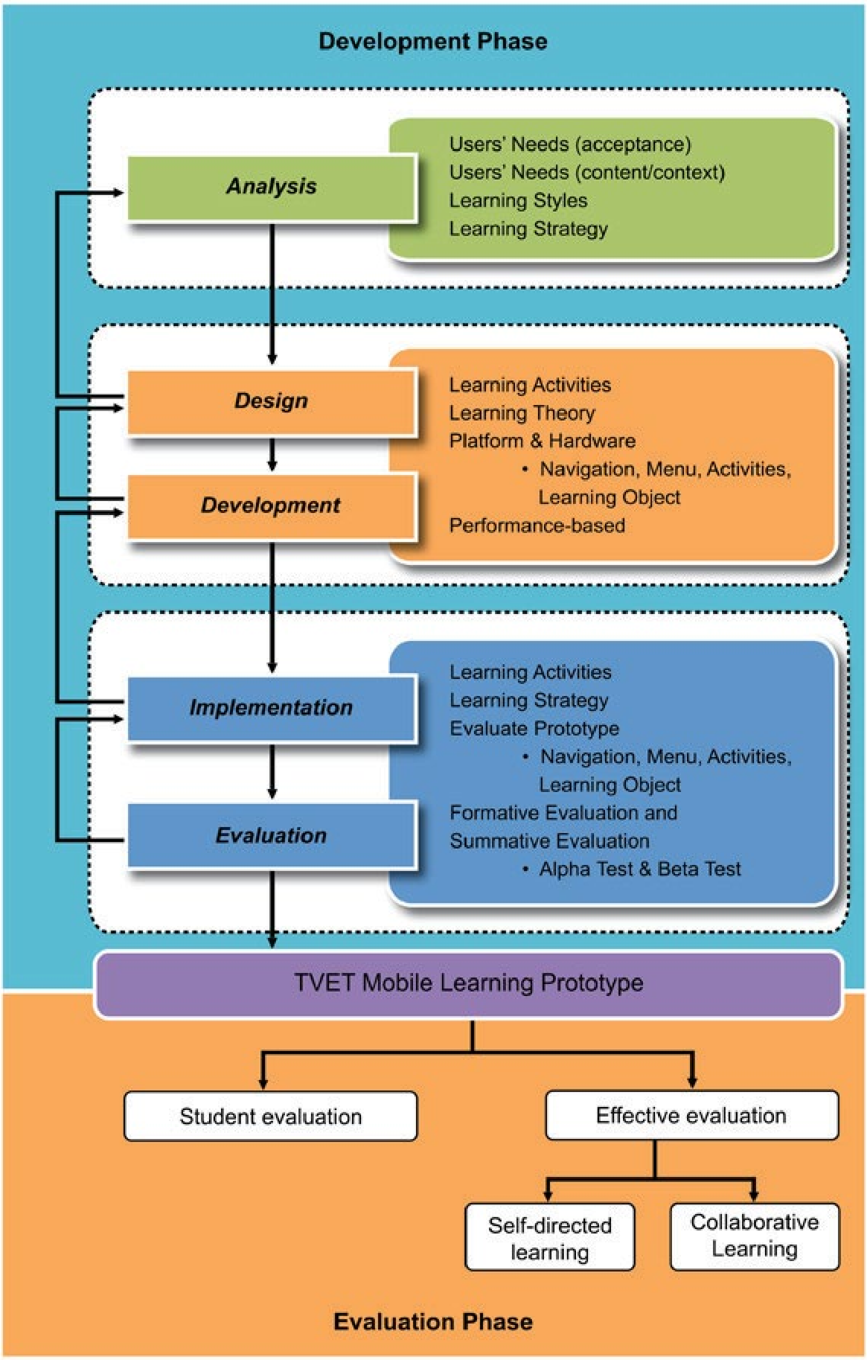


Figure 2 26. Mobile Learning development and Evaluation Framework for a Performance based Environment (Mahazir et al. 2013)

This framework is summarised in Table 2. 20.

Table 2. 20 A summary of mobile learning development and evaluation framework for a Performance based environment (Mahazir et al. 2013)

M-learning characteristics

Pedagogy

2.12.18 Framework for sustainable m-learning in schools

Ng and Nicholas (2013) proposed a person-centred sustainable model for m-learning (Figure 2. 27). The creators of this model suggest that since m-learning requires substantial investment, a sustainable model would ensure investment is not wasted and that further innovation is not threatened. The proposed framework draws on the work of Cisler (2002) who proposed a general framework for sustainability of information and communication technology (ICT) in education. The Cisler (2002) model contains four components of sustainability: (1) *economic sustainability* which refers to the financial capability of an educational institution to ensure the continuity of ICT programmes long-term; (2) *social sustainability* which addresses the stakeholders' involvement in m-learning projects; (3) *political sustainability* refers to the role of leadership and institutional policies required to support m-learning programmes; (4) *technological sustainability* involves decision making about the type of technology that will serve the institutional objectives in the long term. Ng and Nicholas (2013) introduced an additional component (5) *pedagogical sustainability* which refers to teaching/learning practices that support the long-term goals of the mobile learning programmes. Pedagogical sustainability defines the roles of teachers and learners in facilitating teaching and learning with mobile devices and the nature of peer collegiality required to ensure the best pedagogical practices. This conceptual framework re-contextualises the human factors that are embedded in Cisler's framework and explores how the stakeholders interact with each other and with the technology.

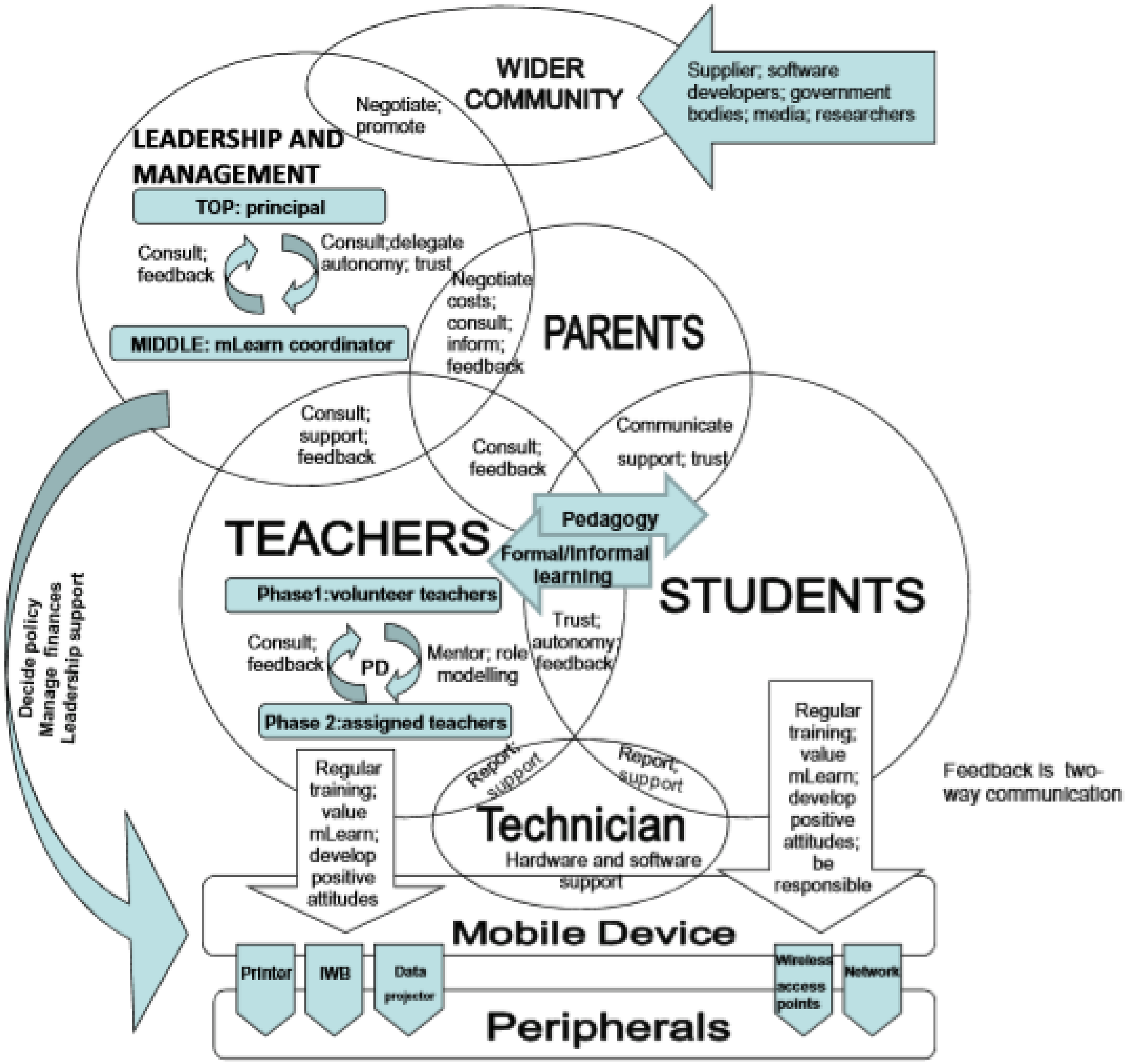


Figure 2. 27 Framework for Sustainable M-learning in Schools (Ng and Nicholas 2013)

In summary this framework considers the aspects shown in Table 2. 21.

Table 2. 21 A summary of framework for sustainable m-learning in schools (Ng and Nicholas 2013)

Stakeholders	M-learning characteristic	Pedagogy

2.12.19 Framework of the context-aware mobile learning system

Zhang et al. (2013) propose a framework for professionals for context-aware m-learning that adapts personal preferences, learning needs and environmental needs (Figure 2. 28). The context-aware m-learning system consists of three parts: *learning context manager* which collects and organises contexts and supplies these to the learning engine; *learning engine*- chooses the contents most relevant to the contexts and selects appropriate collaborating services; *system interface* takes in users' inputs and provides a displaying and collaborating platform. The learning engine receives learning requests from the system interface and acquires contexts from the learning context manager. After internal processing, the learning contexts are collected and the learning units selected. The learning unit is processed, and the learning activity is either consolidated or finished.

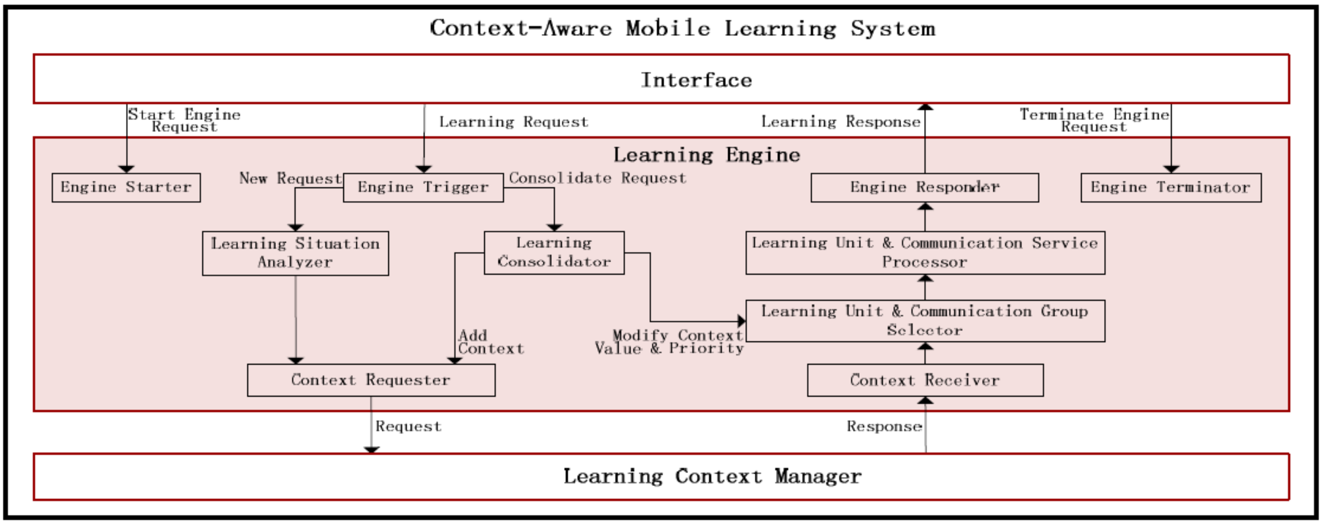


Figure 2.28. Framework of the Context-Aware Mobile Learning System (Zhang et al. 2013)

This framework's features are summarised in Table 2.22.

Table 2. 22 Summary of the framework of the context-aware mobile learning system (Zhang et al. 2013)

Factors influencing m-learning adoption	M-learning characteristics

2.12.20 Scaffolding participatory simulation for mobile learning (SPSML) framework

Yin et al. (2013) offer a conceptual framework called a context aware SPSML (scaffolding participatory simulation for mobile learning). The framework is designed to facilitate experiential learning in social contexts or face-to-face classrooms (Figure 2. 29). The SPSML framework consists of five sequential but cyclic steps: the initial stage, concrete experience, observe and reflect, abstract conceptualization, and testing in new situations. Students could play different participatory roles in mobile simulations and understand abstract concepts better by using the SPSML.

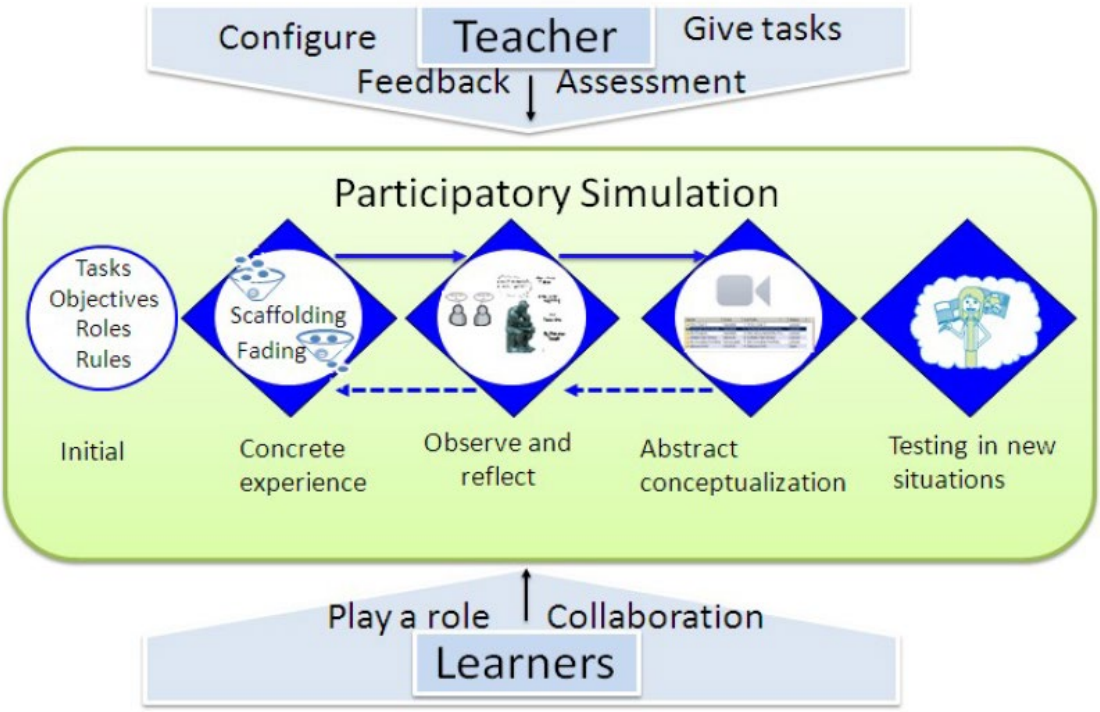


Figure 2. 29 Scaffolding participatory simulation for mobile learning (SPSML) Framework (Yin et al. 2013)

This framework's features are summarised in Table 2. 23.

Table 2. 23 Summary of scaffolding participatory simulation for mobile learning (SPSML) Framework (Yin et al. 2013)

M-learning characteristics	Pedagogy

2.13 Why m-learning in Zimbabwe

Education is widely accepted as a leading tool in economic development (Brown and Lauder 1996; Gylfason 2001; Pinheiro and Pillay 2016). Although there have been improvements in educational indicators in Zimbabwe, such as increased enrolment across the different levels of education, the quality of education still faces significant challenges. Zimbabwe strives to provide basic education for all its citizens including early childhood learners, irrespective of race, sex, age, disability and religion (Mugweni and Dakwa 2013). Education in Zimbabwe has been made accessible to all as a result of aggressive educational policies since independence (Kurasha and Chabaya 2013; Nyoni, Nyoni and Bonga 2017). Zimbabwe in the last decades has given priority to building schools and equipping these schools with computers. However, despite high literacy rates, the academic pass rates remain poor in some schools (Nyoni, Nyoni and Bonga 2017). Access to universities in Zimbabwe has been increased through the establishment of several programmes such as parallel programmes, block release programmes, distance education, and the opening of many universities (Kurasha and Chabaya 2013). Lack of access to quality education continues to be a major impediment to economic growth in developing countries. Governments persistently face the challenge of delivering quality but cost-effective education.

Higher education institutions in Zimbabwe are currently in a series of crises due to a decline in economic growth resulting in under-funding coupled with high student enrolment (Kariwo 2007). This economic decline has greatly impacted the education system, and Zimbabwe's education system once rated the best in Africa, faces immense challenges (Sadomba, Chigwanda and Manyati 2015). The older, more established universities in Zimbabwe are struggling to maintain their infrastructure and the newer institutions have insufficient funds to build their infrastructure (Kariwo 2007). The post-2000 era economic collapse in Zimbabwe has eroded the educational infrastructure developed in the first decades of independence. The education sector in Zimbabwe faces a threat under the weight of socio-economic factors. In some developing countries like Zimbabwe, universities are the key to producing highly skilled manpower and are therefore central to the development of the country. There is a need to improve access to quality and cost-effective education in Zimbabwe. M-learning has the potential to remedy the poor education systems in developing countries.

2.14 Research gap

While previous researchers have defined m-learning in various ways (Peng et al. 2009; Ferreira et al. 2013; Winters 2007), few have examined whether the definitions influence the research, design, practice and evaluation of using mobile technologies (Grant 2019). A clearer theoretical framework is needed to ground research in the unique affordances while also addressing the challenges associated with m-learning in specific contexts. M-learning characteristics are needed to help practitioners in the design of learning environments which should be underpinned by sound pedagogical theory.

Previous researchers have examined the various combinations of factors which influence m-learning implementation, with an emphasis on selected characteristics. Examples to highlight the gaps in literature include: Cochrane (2014) highlights two critical success factors: technical and pedagogical support; Herrington and Herrington (2007) focus on the theoretical underpinnings of m-learning; (Imtinan, Chang and Issa 2013; Ozdamli and Cavus 2011) point out the characteristics of m-learning; (Liu, Li and Carlsson 2010; Cheon et al. 2012) factors driving m-learning adoption; Osang, Ngole, and Tsuma (2013) point out the challenges to m-learning implementation.

The examined m-learning frameworks from both developing and developed countries focus on selected aspects or themes of m-learning, making it impossible to generalise these frameworks to the Zimbabwe tertiary education sector as there are shortcomings in the conceptual models. Therefore, the frameworks reviewed above would be inappropriate for the Zimbabwean context. There is a need to conduct research which includes all key aspects to examine how they collectively influence m-learning implementation. Implementing m-learning in Zimbabwe, as in most developing countries, is complex as different aspects have to be considered and the reality of Zimbabwe is different from that of other developing countries.

Table 2. 24 shows m-learning models from both developing and developed countries and the various themes investigated. In Table 2. 24, X, indicates the absence of the aspect indicated in the corresponding column and a ✓indicates the presence of the specific aspect.

Table 2. 24 M-learning frameworks

Framework	Country	Stake holders	Challenges to m-learning			Factors influencing m-learning adoption			M-learning Characteristics										Pedagogy		
			Investment cost	Infrastructure	Policies	Hci	Cheaper mobiles phones	Culture	Mobility	Context	Interactive	Technical support	Ubiquity	Usability	Training	Collaboration	Blending	Portability	Learning theories	Learners' expectations	Lecturers' expectations
(Barker, Krull, and Mallinson 2005)	South Africa	✓	✓	✓	✓	X	✓	X	X	X	✓	X	X	✓	✓	✓	✓	✓	X	X	X
(Masters 2005)	South Africa	X	X	X	X	X	✓	X	✓	X	X	X	✓	X	X	X	X	X	✓	✓	✓
(Sharples, Taylor, and Vavoula 2005)	United Kingdom	X	X	X	X	X	X	X	X	✓	✓	X	X	X	X	✓	✓	✓	✓	X	X
(Parsons, Ryu, and Cranshaw 2006)	New Zealand	X	X	X	X	✓	X	X	✓	✓	✓	X	✓	✓	X	✓	✓	✓	✓	X	X
(Adesope, Olubunmi, and McCracken 2007)	Nigeria	X	✓	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	X	X
Motiwalla (2007)	USA	X	X	X	X	✓	✓	X	✓	X	✓	X	✓	✓	X	✓	✓	X	✓	X	X
(Liu et al. 2008)	China	X	X	✓	X	X	X	X	✓	X	X	X	X	✓	✓	✓	✓	✓	✓	X	X
(Wains and Mahmood 2008)	Pakistan	X	X	X	X	X	✓	X	✓	X	X	X	✓	X	X	X	X	✓	X	X	X

(Koole 2009)	Canada	X	X	X	X	✓	X	X	✓	✓	✓	X	X	✓	X	✓	✓	✓	✓	X	X
(Peng et al. 2009)	Taiwan	X	X	X	X	✓	X	X	✓	✓	X	X	✓	✓	✓	✓	✓	✓	✓	X	X
(Ford and Botha 2010)	South Africa	✓	X	X	X	X	✓	X	X	X	✓	✓	X	X	X	X	X	X	✓	X	✓
(Mahazir et al. 2013)	Malaysia	X	X	X	X	X	X	X	X	X	✓	X	X	X	X	✓	✓	✓	✓	✓	X
(Park 2011)	USA	X	X	X	X	X	X	X	✓	✓	✓	X	✓	X	X	✓	✓	✓	✓	X	X
(Kearney et al. 2012)	Australia & United Kingdom	X	X	X	X	X	X	X	✓	✓	✓	X	✓	X	X	✓	✓	✓	✓	X	X
(Ng and Nicholas 2013)	Australia	✓	X	X	X	X	X	X	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X
(Zhang et al. 2013)	China	X	X	X	X	✓	X	X	X	✓	X	X	✓	X	X	X	X	✓	X	X	X
(Yin et al. 2013)	Japan	X	X	X	X	X	X	X	X	✓	✓	X	X	X	X	✓	✓	✓	X	X	X
(Ahmed and Ghareb 2017)	Iraq	X	X	✓	X	X	✓	X	X	X	✓	✓	✓	✓	✓	X	✓	✓	X	✓	X
(Tuparov, Al-Sabri, and Tuparova 2019)	Yemen	X	X	X	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X

While the different m-learning frameworks give varied and useful insights into what can be included in a mobile-learning model, Zimbabwe should innovate according to its needs and context. In search for a model for m-learning Zimbabwe, the study will consider the concept of university as a learning culture as understood by Bruner (1996), which assumes not only development of the institution itself, the adjustment to the environment as well as the going beyond the so far established limits of activity. A growing body of scholars, educators and policy makers have argued for reconceptualising education institutions as learning organisations, which can handle the changing external environment, facilitate and sustain organizational change and innovation that improve student outcomes (Kools et al. 2020). Initiative, creativity and progress as fundamental determinants of university culture, may be realised only when a university becomes a unit of educational improvement, taking into account the learners' real needs and developing learners' feelings of self-effectiveness in university matters and educational goals. In developing a model for m-learning for higher education in Zimbabwe the researcher will take into account the comparative model of the quality of education (Marshall 2019; Noah and Eckstein 1988). The model takes into account a description of the traditions and newest trends in education, examining educational systems from a cross-cultural perspective. The model affords researchers to consider trends in higher education from developed and developing countries, which help predict changes. There is need for an m-learning model with a Zimbabwean flavour that takes into consideration the resources available in Zimbabwe and that can be applied to other countries similar to Zimbabwe.

2.15 Proposed initial model

The initial proposed m-learning model for Zimbabwe higher education is derived from the current frameworks discussed in Section 2.11. The proposed model also takes into account other m-learning studies which take into consideration other aspects relevant to Zimbabwe which are stakeholders, challenges of m-learning, factors that motivate m-learning adoption, key characteristics of m-learning and pedagogy. The proposed initial model is depicted in Figure 2. 30.

2.15.1 Stakeholders

A stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organization's objectives (Freeman 2010). In this study, the stakeholders of m-learning would be the people who can affect or are affected by m-learning in tertiary institutions in Zimbabwe. The definition offered by Freeman (2010) suggests that stakeholders in both the internal and external organizational environments need to be considered. Table 2.25 below lists the various m-learning stakeholders.

Table 2. 25 M-learning stakeholders

Stakeholder	How stakeholders affect or are affected by m-learning
Learners	These are the consumers of m-learning. In the context of tertiary institutions these would be undergraduates or postgraduate students enrolled in a university or college. Learners are the customers of higher education and contribute to the teaching process (Jongbloed, Enders, and Salerno 2008).
Lecturers	These guide the educational experience of learners, m-learning presents new ways of teaching. Lecturers may embrace or resist m-learning as a new development (Duncan-Howell and Lee 2007).
Library Staff	These have an understanding of faculty needs and can help in the information strategy of tertiary institutions in the digital age. The library is the gateway for locating information Housewright and Schonfeld (2008).
Faculty heads	These are responsible for the academic leadership and management of the school in the university.
University IT staff	These provide IT support to learners and lecturers.

2.15.2 Challenges to m-learning

The implementation and adoption of m-learning faces numerous challenges as discussed in section 2.9. In the initial model, the first three challenges to be investigated are discussed below based on their significance to the Zimbabwean context.

2.15.2.1 Infrastructure

In the proposed research model, the researcher has taken into account the challenges associated with m-learning. The researcher understands that these challenges can impede the effective design and implementation of m-learning in Zimbabwe. Poor infrastructure in the form of unreliable electricity supplies and poor Internet connectivity is a major challenge to m-learning as discussed in section 2.9.1.

2.15.2.2 Cost

Another major barrier to m-learning adoption is the initial high investment costs. There are high costs associated with equipment, connectivity, technical support, training and maintenance as presented in section 2.9.2.

2.15.2.3 Policy

The challenges related to policy are explained in section 2.9.3.

2.15.3 Factors influencing m-learning

It is important to investigate the factors that may influence m-learning adoption. These factors are important as they shed light on the reasons why m-learning may or may not be adopted. It is important to find out from the stakeholders what it is that actually influences m-learning adoption. The success of m-learning depends heavily on these factors. Literature shows that various factors influence m-learning adoption. The initial model will start off by investigating usability, affordability and culture.

2.15.3.1 Usability

Usability as a factor affecting m-learning adoption is explored in section 2.8.1.7.

2.15.3.2 Affordability

Zimbabwe has a mobile density of 100% and above (Kabanda 2014b, 20). A high prevalence of mobile phones in Zimbabwe may positively influence learners to adopt m-learning. Affordability as a factor of m-learning is outlined in section 2.8.1.2

2.15.3.3 Culture

The effect of culture on m-learning adoption has been explained in section 2.9.4.

2.15.4 M-learning characteristics

The characteristics of m-learning will be identified in terms of tertiary institutions in Zimbabwe in order to produce a model for m-learning in Zimbabwe. Some key characteristics of m-learning identified in the literature are explained in Section 2.8.1.

2.15.5 Pedagogy

Pedagogy is outlined in Section 2.10.

2.15.5.3 Stakeholders' expectations

It is important understand the stakeholders' expectations of m-learning. Both lecturers and learners need to adopt new roles, and change their attitudes towards ICTs (Sife, Lwoga and Sanga 2007; Chen, Xin and Chen 2017). Lecturers' perceptions of and attitudes towards m-learning, explored in section 2.5, suggest some of the expectations lecturers may have regarding m-learning. Similarly, section 2.6 investigated students' attitudes towards m-learning and indicated some of the students' expectations of m-learning. This study will investigate the expectations of other stakeholders identified in section 2.13.1. In order for the different stakeholders to be satisfied with m-learning activities offered at tertiary institutions, the m-learning model should have a robust design with regards to the technology in terms of the link with pedagogical goals, interface and m-learning environment founded on the stakeholders' concerns and expectations.

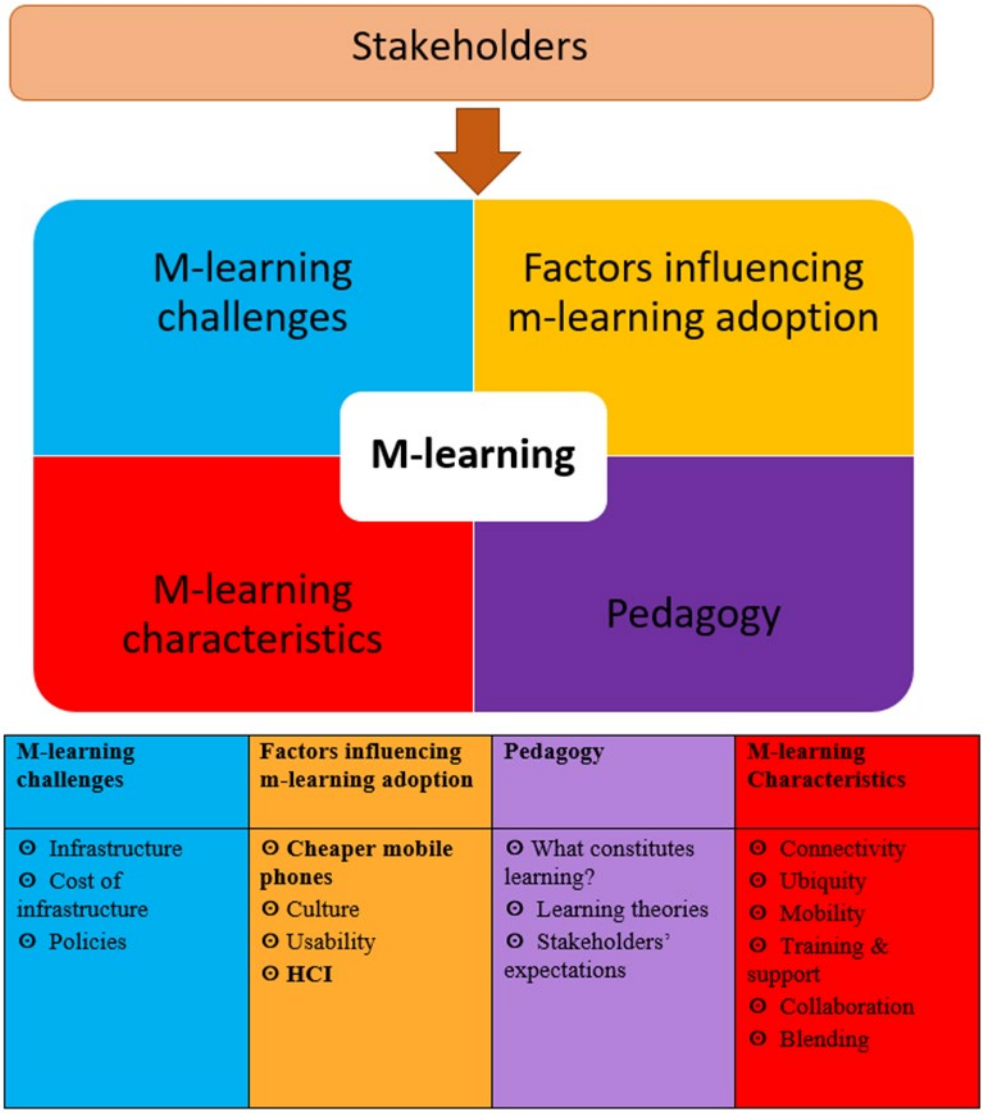


Figure 2.30. Initial proposed model

2.16 Conclusion

This chapter provides a detailed review and synthesis of extant literature on m-learning in higher education settings. The chapter starts by discussing the scope of the literature review. Definitions of m-learning are explored, theoretical perspectives of m-learning, as well the characteristics of m-learning, and the challenges of implementing m-learning. This chapter also explores the negative aspects of m-learning such as learners' discomfort and the issue of ethics in m-learning. This chapter identifies gaps in extant research. Several models on m-learning from both developed and less developed countries are examined. A summary of the key aspects of each of the models is provided. It is evident that most research in m-learning emanates from developed countries. From the examined m-learning models it is impossible to generalise these models to the Zimbabwe tertiary sector as there are shortcomings in the conceptual models. Zimbabwe has to be innovative in its implementation of m-learning to meet the needs of the Zimbabwe education sector. The importance of m-learning to Zimbabwe's higher education is explored. The literature review highlights that little attention has been given to various stakeholders when implementing m-learning. The chapter discusses some stakeholders' perceptions of m-learning. There are few qualitative studies that consider key stakeholders when implementing m-learning. There is need to explore factors that influence m-learning implementation specifically in developing countries for successful m-learning implementation on a large scale. The initial model is developed based on the current literature review and will be modified based on the findings of the mixed-methods approach to create a model that best suits the Zimbabwean context. Chapter 3 explains the methodology adopted for this thesis.

Chapter 3

Research methodology

3.1 Introduction

Chapter 2 provided a detailed review and synthesis of extant literature on m-learning in higher education settings. This chapter describes the research method design adopted to achieve the aims and objectives of this study. The chapter commences with a discussion of the research questions and research objectives. The significance of the study is then explored. This is followed by the research methodology model adopted for this study, discussing the research philosophy, the research paradigm and justifications of the techniques employed for the data collection, and the procedures used to analyse the collected data. The research design considerations are explored in detail as well as the rigour of the data collection and data analysis approaches employed in this study. This chapter concludes with data management and the ethical considerations for this study.

3.2 Research Questions

M-learning on a large scale is in its infancy in many developing countries, particularly in tertiary institutions. M-learning implementation models in higher education to address the needs for developing countries are scarce. Models for m-learning describe how the mobile technologies play specific roles in supporting teaching and learning. Rigorous research is required to understand the different aspects that impact m-learning implementation from different stakeholders' perspectives, in order to develop suitable models for developing countries. To determine the various factors that influence m-learning implementation in higher education settings, there is a need to study and evaluate different stakeholders' perceptions and expectations of m-learning. This leads to the following research questions and research objectives presented in Table 3. 1.

Table 3. 1 Research questions and research objectives

Research Questions	Research Objectives
What are the factors that influence the implementation of mobile learning in Zimbabwe?	To identify the factors that influence the implementation of mobile learning in Zimbabwe.
What are the stakeholders' personal perspectives and perceptions of the mobile learning model?	To assess stakeholders' perspectives and perceptions of the mobile learning model.
What are students' readiness and acceptance of mobile learning in Zimbabwe?	To investigate student readiness and acceptance of mobile learning in Zimbabwe.
What are the recommendations for mobile learning in tertiary institution in Zimbabwe?	To offer recommendations for mobile learning in tertiary institution in Zimbabwe.

1. **What are the factors that influence the implementation of mobile learning in Zimbabwe?**
   There is a need to determine whether different stakeholders would accept mobile technologies as learning tools. Therefore, the findings prompted by this question can determine the acceptance of m-learning by the different stakeholders. By addressing this question, it may be possible to determine the resources that are required for m-learning implementation and subsequently help ensure students' learning success.
2. **What are stakeholders' personal perspectives and perceptions of the mobile learning model?**
   M-learning implementation in higher education is complex; hence, understanding the different stakeholders' perceptions of m-learning will give a clearer picture of the specific context and thus increase the chances of successful implementation of m-learning on a large scale.
3. **What is students' readiness and acceptance of mobile learning in Zimbabwe?**
   Having a deeper understanding of m-learning among students can lead to a more accurate personalised implementation that is suitable for the specific context under investigation.
4. **What are the recommendations for mobile learning in tertiary institution in Zimbabwe?**
   Based on the findings of the study, what are the steps that need to be taken for the successful implementation and adoption of m-learning in Zimbabwe?

3.3 Significance of the research

This research project makes both theoretical and practical contributions. This research aims to extend what is already known about m-learning in higher education settings in Zimbabwe. It is anticipated that this study will contribute to further research directions in the implementation and adoption of m-learning on a large scale in Zimbabwe tertiary institutions.

3.3.1 Theoretical significance

The aim of this study is to contribute to theoretical knowledge about various aspects underlying the successful implementation of m-learning in universities, both generally, and more specifically in relation to the mainstream higher education sector of Zimbabwe. The latter poses a set of challenges that require careful investigation prior to the introduction of widespread m-learning in university pedagogy. By combining various approaches drawn from literature on the implementation of m-learning globally, this study proposes a framework consisting of different features which support a well-considered integration of mobile technologies that will benefit teaching and learning in higher education in Zimbabwe. Although it is important to integrate features of best practice drawn from other m-learning projects, it is essential to consider the immediate context of the host country. The cultural biases of m-learning are predominantly those of the Western countries which may not align with those of developing countries (Traxler 2018). In developing an m-learning model for Zimbabwe tertiary institutions, the socio-cultural context should be considered as it influences pedagogy and learning.

M-learning in higher education is at the experimental stage in developing countries (Kaliisa, Palmer and Miller 2019). Given the infancy of m-learning in higher education settings, it is unsurprising that there are limited studies on m-learning integration in developing countries. There is need for a holistic approach that considers different stakeholders and assesses the various challenges facing m-learning implementation (Lamptey and Boateng 2017). This study employees a mixed-methods approach and gathers the opinions of a variety of stakeholders. This will add to the body of knowledge as it indicates what would be appropriate for a developing country like Zimbabwe. M-learning studies in developing countries lack robustness, possibly because technology diffusion is generally from industrialised nations to developing countries. It can be challenging for developing countries to adopt models from developed countries given the great differences between the two (Lamptey and Boateng 2017). It is important to ascertain from literature the factors that can account for a wide array of issues surrounding the m-learning Zimbabwean context. This study will make a theoretical contribution in that it will show how each aspect of the proposed conceptual model is interacting with others, and how all aspects will synergistically influence m-learning implementation. The study further seeks to contribute to theoretical knowledge by offering recommendations for the successful implementation of m-learning in developing countries. Students, researchers, and academics will be able to use this model as a reference in future studies.

3.3.2 Practical significance

From a practical perspective, the research aims to introduce an m-learning model for tertiary institutions in Zimbabwe, to integrate technology in their teaching and learning approaches. It is anticipated that the m-learning model will encourage m-learning implementation and adoption in Zimbabwe and will be adopted by other educational institutions in this country. The m-learning model will provide guidelines for instructional designers and lecturers when designing m-learning activities and blending these with existing teaching and learning practices. Also, the Ministry of Education in Zimbabwean, the universities, students, and other stakeholders will benefit from this model. Students will be able to experience dynamic learning anywhere anytime. The recommendations can be utilized by universities and stakeholders in other developing countries that are planning to implement mobile learning initiatives in their education sectors, especially in Africa. By promoting m-learning on a large scale and endorsing current technology in higher education, tertiary institutions ensure that the education quality is aligned with international standards, which can attract more students.

3.4 Research methodology model

The selection of techniques used to obtain data and the procedures used to analyse data have been considered in relation to design elements. This was done by adopting the "research onion" model by (Saunders, Lewis and Thornhill 2016) which shows how different layers of the research process have implications for data collection and analysis. Figure 3.1 presents the research methodology model which shows the research philosophy applied and the methodological choices made by the researcher, the research strategies employed for data collection, techniques and procedures applied in data collection and analysis. The specific aspects of the research onion that are adopted for this research are represented by the red solid rectangles; for example, pragmatism was adopted as the research philosophy.

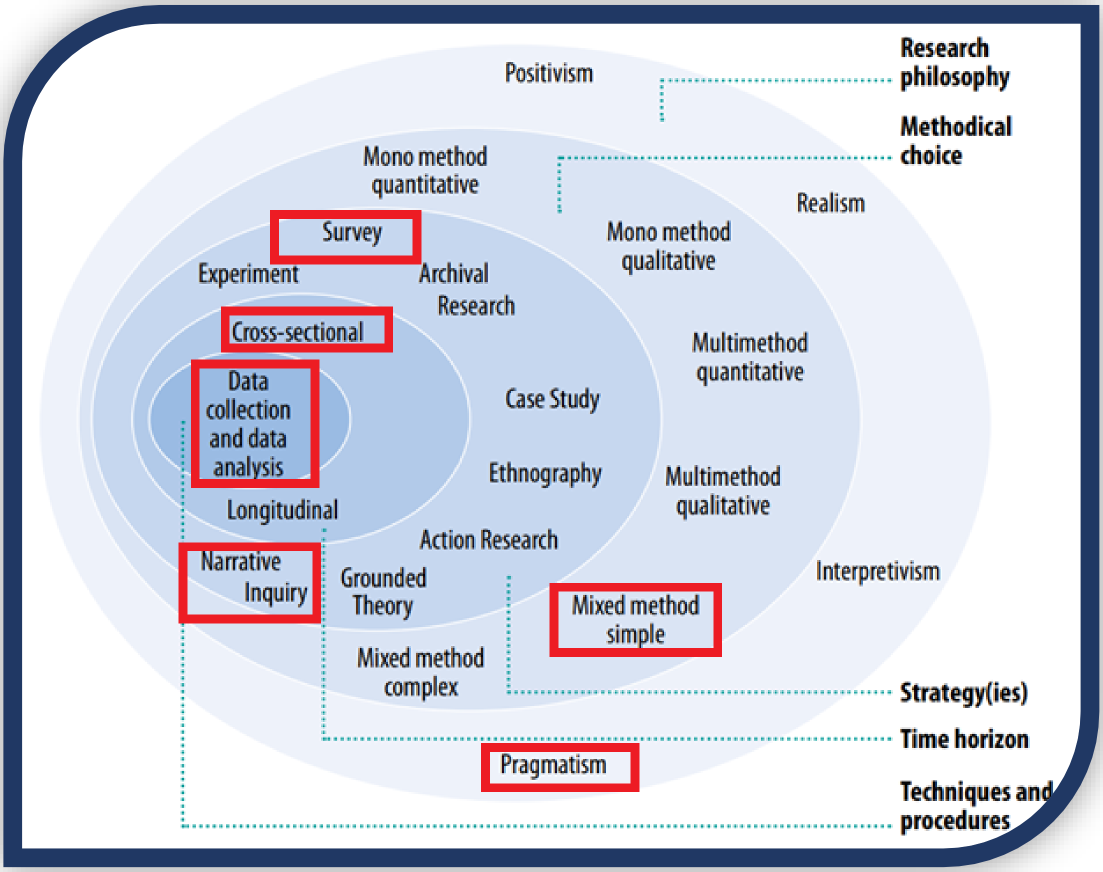


Figure 3.1. Research model adapted from the research onion (Saunders, Lewis and Thornhill 2016) (prepared by researcher)

3.5 Research philosophy

A paradigm is a set of generalisations, beliefs and values of a community of specialists (Kuhn 1970). The two main philosophical concepts to distinguish existing research paradigms are ontology and epistemology (Saunders, Lewis and Thornhill 2016; Kalof, Dan and Dietz 2008). To formulate a research design, it is important to articulate one's ontology (O'Gorman and MacIntosh 2014). Ontology refers to assumptions about the nature of reality and is concerned with the nature of existence and the structure of reality (Crotty 1998). Ontology addresses the questions "What is the form and nature of reality, and what can be known about that reality?"

(Ponterotto 2005, 130). The researcher's position regarding his/her perceptions of reality and how things really work has implications for the research design. The research philosophy is shown in Figure 3.2.

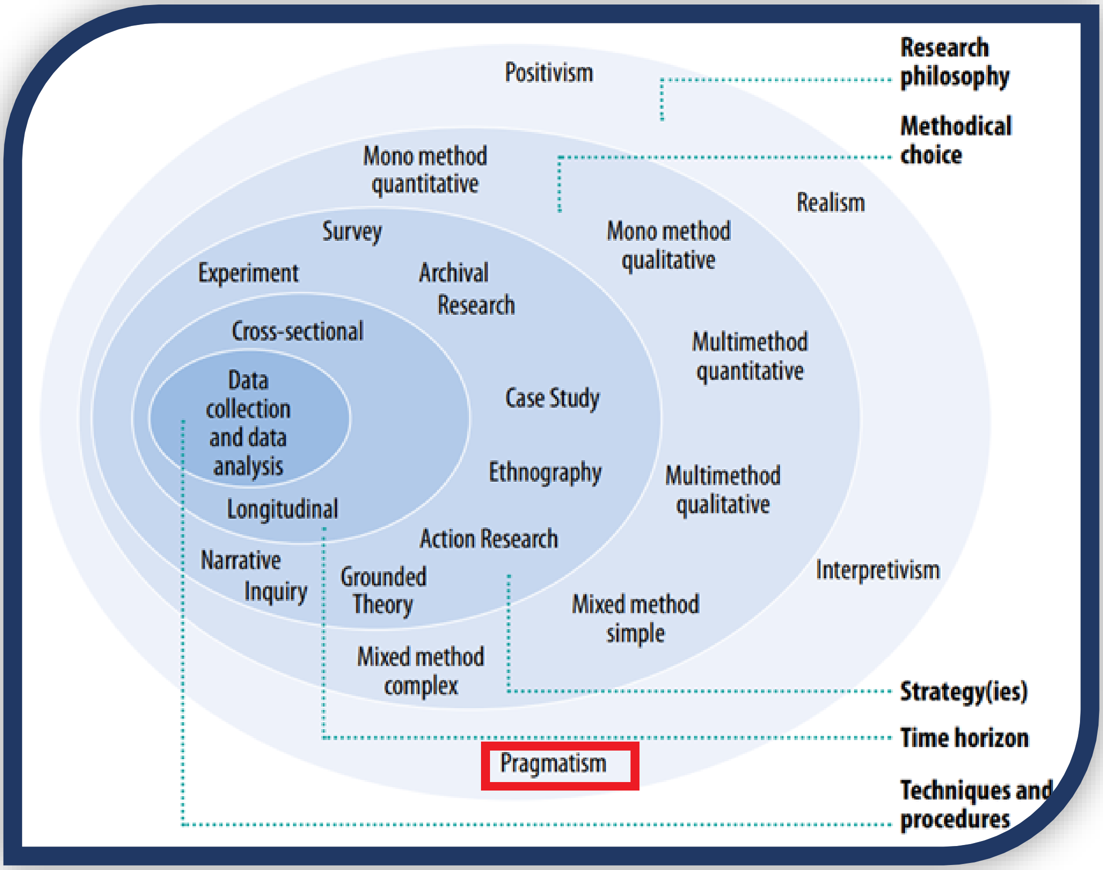


Figure 3.2. Research philosophy applied in this study adapted from the research onion (Saunders, Lewis and Thornhill 2016)

3.5.1 Epistemology

Epistemology relates to assumptions about knowledge. This looks at what constitutes valid, legitimate and acceptable knowledge and how the knowledge can be transmitted to others (Burrell and Morgan 1979). Epistemology concerns the way that researchers acquire knowledge about what they know (Clark and Creswell 2011; O'Gorman and MacIntosh 2014). Epistemology is concerned with the relationship between the researcher and the research participant (Ponterotto 2005). Krauss (2005, 759), asserts that epistemology poses the following questions: What is the relationship between the knower and what is known? How do we know what we know? What counts as knowledge? Epistemological assumptions are concerned with how knowledge is generated, obtained and communicated or used (Scotland 2012; Wahyuni 2012). Epistemology provides a philosophical grounding for deciding the kinds of knowledge that are possible and how to ensure that these kinds of knowledge are adequate and legitimate (Maynard 1994). There are a range of epistemologies that give a researcher a choice of methods. However, it is important to understand the implications of the different epistemologies in relation to the choice of methods and the strengths and limitations of subsequent research findings (Saunders, Lewis and Thornhill 2016). Two epistemologies are objectivism and subjectivism which have been described as extreme opposites on a continuum with varying philosophical positions between them.

3.5.1.1 Objectivism

Objectivist epistemology asserts that meaningful reality exists as such apart from the operation of any consciousness (Crotty 1998). Objectivism contains the assumptions of natural sciences arguing that the social reality that we research is external to us and others (Saunders, Lewis and Thornhill 2016). Objectivism has its roots in realism. Realism believes in the existence of the real world external to humans and independent of human existence (Jonassen 1991). This position assumes that we all acquire the same understanding and that the world is structured.

3.5.1.2 Subjectivism

This epistemology makes assumptions about the arts and humanities, emphasizing that social reality is constructed from perceptions and consequent actions of people (Saunders, Lewis and Thornhill 2016). In subjectivism, meaning is imposed on the object by the subject and does not come from an interaction between subject and object (Crotty 1998). The object, therefore, makes no contribution to the generation of meaning. In subjectivism, meaning comes from anything *but* an interaction between the subject and the object (Crotty 1998). Subjectivism embraces nominalism. Nominalists subscribe to the notion that there is no underlying reality to the social world beyond what people attribute to it and that, since each person experiences and perceives reality differently, it is better to consider multiple realities rather than a single reality for everyone (Burrell and Morgan 1979). A summary that compares the extreme epistemologies based on the work of (Saunders, Lewis and Thornhill 2016; Jonassen 1991; Flick 2018) is given in Table 3.2.

Table 3. 2 Comparison of objectivism and subjectivism based on the work of (Saunders, Lewis and Thornhill 2016; Jonassen 1991; Holden and Lynch 2004; Flick 2018)

	Questions	Objectivism	Subjectivism
Ontology	What is the nature of reality?	Real	Nominal /decided by convention
	What is the world like?	External	Socially construed
Epistemology	How can we know what we know?	Adopt assumptions of natural science	Adopt the assumptions of arts and humanities
	What is considered acceptable knowledge?	Facts	Opinions
	What constitutes good-quality data	Numbers	Narratives
	What kinds of contribution to knowledge can be made?	Observable phenomena Law-like generalisations	Attributed meanings Individuals and contexts, specifics
Theoretical perspective		Positivism	Interpretivism
Generalisations		In order to be able to generalise about regularities in human and social behaviour it is necessary to select samples of sufficient size; aim of generalisations is to lead to prediction, explanation and understanding	Everything is contextual; involves identifying patterns – theories then developed for understanding
Research language		Formal, based on set definitions; impersonal voice; use of accepted quantitative words	Informal, evolving decisions; personal voice; use of accepted qualitative words.

3.5.2 Positivism

Research which is positivist tends to predominantly apply quantitative approaches for data collection and analysis, while interpretivist research generally operates using principally qualitative approaches (Chen and Hirschheim 2004; Firestone 1987; Kaplan and Duchon 1988; Straub, Boudreau and Gefen 2004; Ponterotto 2005; Lee 1991). Methods used to understand the natural world are not always directly transferable to the social world which brings limitations to positivism (Scotland 2012). Some of the limitations of positivism discussed in the literature include :(1) positivism endeavours to reduce the complex to simple by simplifying and controlling variables which can be difficult in educational research; (2) some variables may be hidden from the researcher and only become known when their effects are evident, therefore predictions could be correct due to random reasons; (3) inferential statistical tests are often misused, the results often misinterpreted and results of statistical significance are dependent upon the sample size; and (4) deduction from empirical generalisation is rarely explanatory, so actions are not fully understood (Lincoln, Guba and Pilotta 1985; Burrell and Morgan 1979; Blume and Peipert 2003). This study adopts approaches that will circumvent the limitations of positivism and interpretivism.

From an Information Systems perspective, positivism has some limitations, two of which will be explained. The quest for universal laws leads to a neglect of historical and contextual situations as possible triggers of events or influences on human action (Orlikowski and Baroudi 1991). The design and use of ICT in organisations is embedded in social contexts, marked time and culture (Orlikowski and Baroudi 1991). A positivist approach may not take into consideration how previous practices or history may determine what is being measured e.g. satisfaction level. Another limitation of the positivist approach highlighted by Orlikowski and Baroudi (1991) is that it focuses on validity and control of research procedures and as a result adopts predefined and circumscribed positions in regard to the subject under investigation. In ICT research, there may be a need for reciprocal relationships. Research can only discover one-sided things if it insists on setting up one-sided relationships since one only gets answers to the questions one is asking (Rowan 1973). In this study, to circumvent the positivist limitations from the perspective of Information Systems, a positivist approach was not taken.

3.5.3 Interpretivism

A solution to the limitations of the positivist approach could be an interpretivist approach. The interpretivist approach supports the understanding of nuances, influences, perceptions and how the context of an institution can influence the research participants Stockdale and Standing (2006). Shortcomings of the interpretivist approach discussed in literature (Burrell and Morgan 1979; Kaplan and Duchon 1988; Lee 1989; Fay 1987) include the following:

(1) How quality can be assessed.

(2) Provide less explanation of variance in statistical terms.

(3) The risk of improper interpretation.

(4) The lack of power to randomise that can lead to problems of generalisability and repeatability.

(5) The interpretive perspective disregards historical change, i.e. how a particular social order came to be what it is, and how it is likely to vary over time, thereby ignoring structures that could generate change.

3.5.4 Pragmatism

Pragmatism strives to reconcile both objectivism and subjectivism by bringing together facts and figures as well as rigorous knowledge and the different contextual experiences (Saunders, Lewis and Thornhill 2016). Pragmatism aims to interrogate a particular theory, phenomenon or particular question with the most appropriate research method (Feilzer 2010). This is done by considering concepts, theories, ideas and research findings in terms of their practical consequences. Pragmatism has been summed up as simply asking about "what works" (Dewey 1908; Rorty et al. 2004). Morgan (2014) suggests clarifying the value of pragmatism by going beyond an emphasis of practicality. Pragmatism offers a world view that is not limited to positivism and interpretivism, thus side-stepping contentious issues of truth and reality, but accepts that there are singular and multiple realities open to empirical inquiry and drives itself towards solving practical problems (Creswell 2013; Saunders, Lewis and Thornhill 2016; Feilzer 2010). Pragmatism provides a fusion of approaches which deals with challenging what are regarded as sterile and unproductive dualisms (Denscombe 2008). On some occasions, pragmatism provides a third alternative for researchers who decide that neither the qualitative nor quantitative approaches offer adequate findings for the research project (Johnson, Onwuegbuzie and Turner 2007). Pragmatism is a suitable approach for this study as the researcher attempts to circumvent the limitations of both positivism and interpretivism.

To date, researchers of m-learning have usually taken the quantitative approach (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016; DeWitt, Siraj and Alias 2014; Munguatosha, Muyinda and Lubega 2011; Iqbal and Qureshi 2012; Liu, Li and Carlsson 2010; Park, Nam and Cha 2012) particularly when investigating factors that lead to m-learning adoption by students. Pragmatism is appropriate as a basis for research approaches, intervening in the world and not merely observing the world (Goldkuhl 2012). The researcher contends that in order to obtain adequate findings, this study will require both qualitative and quantitative approaches. Pragmatism was adopted for the study because it focuses on the problem to be researched and the consequences of the research (Saunders, Lewis and Thornhill 2016; Creswell 2013; Tashakkori and Teddlie 2010). Pragmatism assesses the usefulness of the outcome and chooses appropriate methods to go beyond "what works" by focussing on the importance of joining beliefs and actions during an investigation (Morgan 2014). In this study, the researcher deems the research problem was more dominant than the method. The data collection and analyses methods used in this study are perceived to be the factors that will provide deep insights into the research problem, making pragmatism an ideal choice (Parvaiz, Mufti and Wahab 2016). In addition, pragmatism enabled the researcher to investigate m-learning from a theoretical perspective and also examine the practical implications in the Zimbabwean context. With the pragmatic approach, this empirical study will be able to investigate in-depth the issue of m-learning in higher education settings in Zimbabwe.

3.6 Methodical choice

Research designs comprise the techniques used for collecting, analysing, interpreting, and reporting data in research studies. The multiplicity of research methods is considered a major strength in Information Systems (Sidorova et al. 2008; Robey 1996). This study employs the mixed-methods approach for the research design as shown in Figure 3.3. Mixed-methods, unlike the monomethod enable researchers to utilise quantitative approaches to inform qualitative studies and vice-versa Onwuegbuzie and Leech (2004). This results in harnessing the strengths of the complementary approaches and reducing the individual weaknesses of the qualitative and quantitative approaches in isolation. Data from a mixed-methods approach enables researchers to test theoretical models and to modify them based on participant feedback (Greene and Caracelli 1997). Mixed-methods enable the researcher to simultaneously ask confirmatory and exploratory questions and therefore verify and generate theory in the same study (Teddlie and Tashakkori 2009). Proponents of the mixed-methods approach also argue that studies following this approach provide rich insights into the phenomenon that is being researched compared to studies that employ either quantitative or qualitative approaches separately (Viberg 2013; Venkatesh, Brown and Bala 2013). Using a mixed-methods approach, the qualitative data provides a deep understanding of the quantitative responses, and the statistical analysis provides a detailed assessment of patterns of responses (Driscoll et al. 2007; Flick 2009). The use of multiple methods (triangulation) reflects an attempt to acquire an in-depth understanding of the phenomenon being researched (Denzin 2012) and gives validity to the study findings.

Although the mixed-methods approach is acknowledged for adding rigour, richness, breadth and depth to an investigation (Denscombe 2008; Flick 2009; Greene, Caracelli and Graham 1989; Venkatesh, Brown and Bala 2013), the researcher was aware of challenges that could arise when using this approach as it is framed by a variety of practical demands (Denscombe 2008). A mixed-methods design can possibly yield heterogeneous results that need to be interpreted carefully (Feilzer 2010). This calls for more reflection and care in the research design, and the analysis and interpretation of findings as this approach requires more effort than does a single-method approach (Greene, Benjamin and Goodyear 2001). Careful consideration is essential when designing data collection techniques, conducting data analyses, and interpreting the results.

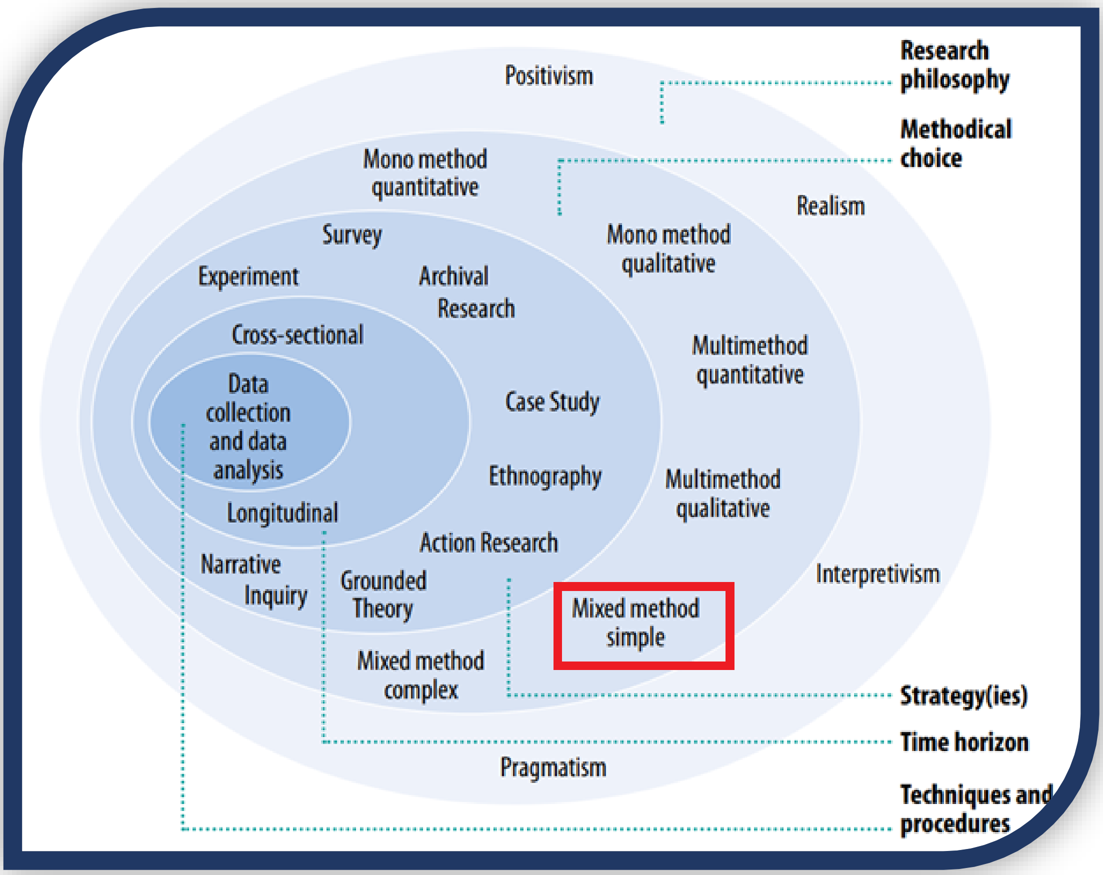


Figure 3.3. Methodological choice for this study adapted from the research onion (Saunders, Lewis and Thornhill 2016)

3.7 Mixed method simple

The researcher, after identifying the research problem and reflecting on the philosophical and theoretical foundations, deemed the mixed-methods approach to be the most appropriate for this study. The mixed-method approach has been praised for producing a holistic rich picture from an investigation (Denscombe 2008; Flick 2018; Cohen, Morrison and Manion 2017). IS researchers should utilise mixed-methods approach with the intention of providing an all-inclusive understanding of a phenomenon for which the extant research is fragmented, inconclusive and equivocal (Venkatesh, Brown and Bala 2013; Lund 2012). Mixed-methods strategies are powerful mechanisms that IS researchers can apply when dealing with situations in which existing theories and findings do not adequately explain significant insights into the phenomenon of interest (Venkatesh, Brown and Bala 2013). This study needs quantitative to generalise the qualitative findings (Pluye and Hong 2014; McKim 2017). The results from the mixed methods may validate each other and provide stronger evidence of conclusion thereby increasing study credibility (Hussein 2009; McKim 2017). The lack of m-learning empirical studies from developing countries and the need to develop a m-learning framework make the mixed-methods approach the best option for this study for the reasons listed in Table 3. 3.

Table 3. 3 Reasons why mixed methods is the best option for this study (prepared by researcher)

- The data collected will be more comprehensive including statistics and words (narratives) combining particularity with generality (Cohen, Morrison, and Manion 2017; Flick 2018).
- The strength of the quantitative approach can be used to overcome the weaknesses of the qualitative approach and vice-versa (Lund 2012; Venkatesh, Brown, and Bala 2013).
- The results from the different methods may validate each other and provide stronger evidence of conclusion thereby increasing study credibility (Hussein 2009; McKim 2017).
- O'Cathain, Murphy, and Nicholl (2010) suggest that in applying the mixed methods approach, integration which is the interaction between the qualitative and quantitative components would increase the amount of knowledge the mixed methods study generate.
- Mixed methods increase the generalisability of qualitative findings (Pluye and Hong 2014; McKim 2017).
- Mixed methods approach may offer more reliability and strengthen validity (Cohen, Morrison, and Manion 2017)

3.7.1 Mixed methods design

This study employs a fixed mixed-methods design. The quantitative and qualitative methods were predetermined and planned at the beginning of the research process with the procedures carried out as planned (Clark and Creswell 2011). There are various approaches to designing mixed-methods studies. A typology-based approach emphasizes the classification of useful mixed-methods designs as well as the selection and adaptation of a particular design to a study's purpose and questions, and is most commonly discussed in mixed-methods literature. Creswell et al. (2003) summarised the range of classifications of mixed methods and these have been updated by (Clark and Creswell 2011). The classifications represent different disciplines and emphasize the different features of mixed-methods design. After careful consideration of the different disciplines, the researcher chose educational research with mixed-methods designs. This study utilises the classification proposed by (Tashakkori, Teddlie and Teddlie 1998). For this study, an exploratory design approach was chosen because of the scant previous research on m-learning in tertiary education in Zimbabwe. This study will begin with the in-depth interviews then the focus groups which will be followed with the survey which is in line with previous studies in m-learning (Wallace, Clark and White 2012; Alenezi 2017). Themes identified from literature and the qualitative studies will be used to construct the survey.

The qualitative and quantitative strands in this study have equal priority, meaning that both strands play an equally important role in this study. The integrating of the qualitative and quantitative strands for this study will be done by connecting the data analysis findings from one set of data to the collection of the following set of data. The researcher, after obtaining and analysing the data from the interviews, uses the findings to build up to the subsequent recruitment of focus groups. The data obtained from the focus groups is analysed and findings lead to the quantitative phase where data is collected by means of a survey. The findings from all the analyses will inform the development of the m-learning model. The summary of how exploratory design will be applied to this study is given in Figure 3. 4 (adapted from (Clark and Creswell 2011).

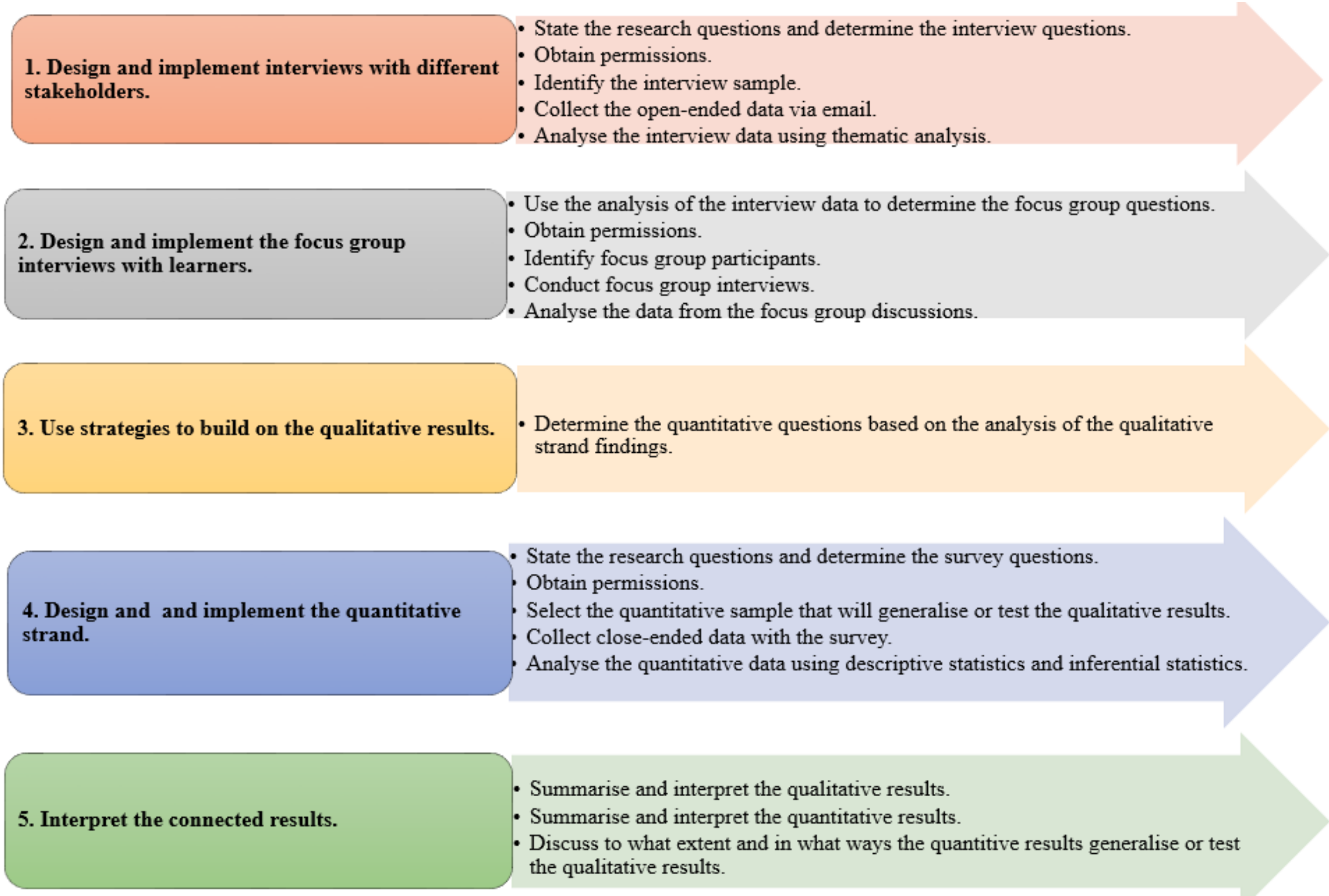


Figure 3.4. Summary of exploratory approach to study adapted from (Clark and Creswell 2011) (prepared by researcher)

3.7.2 Strategies

Data collection for this study involved narrative enquiry and a survey. The narrative enquiry involved interviews and focus group discussions. The survey took a mixed-mode approach involving an online and a paper-based questionnaire (Figure 3. 5).

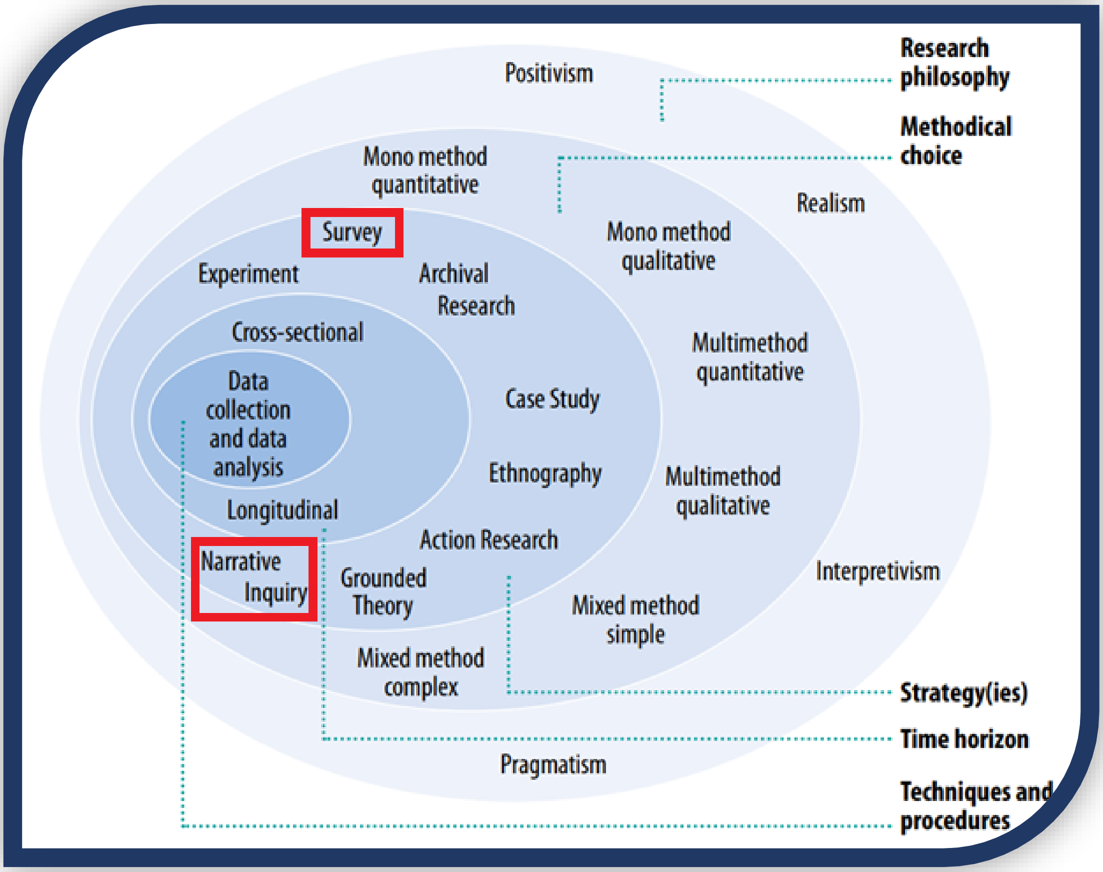


Figure 3.5. Strategies used in this study adapted from the research onion (Saunders, Lewis and Thornhill 2016)

3.8 Time horizon

The time taken to research a phenomenon can be described as either cross-sectional or longitudinal (Saunders, Lewis and Thornhill 2016). A longitudinal study is done by investigating the same situation or people several times or continuously, over the period in which the problem runs its course. A cross-sectional study, on the other hand, is conducted when there are constraints of time or resources, data is collected once, over a short period of time before it is analysed and interpreted. This study is a cross-sectional study (Figure 3. 6).

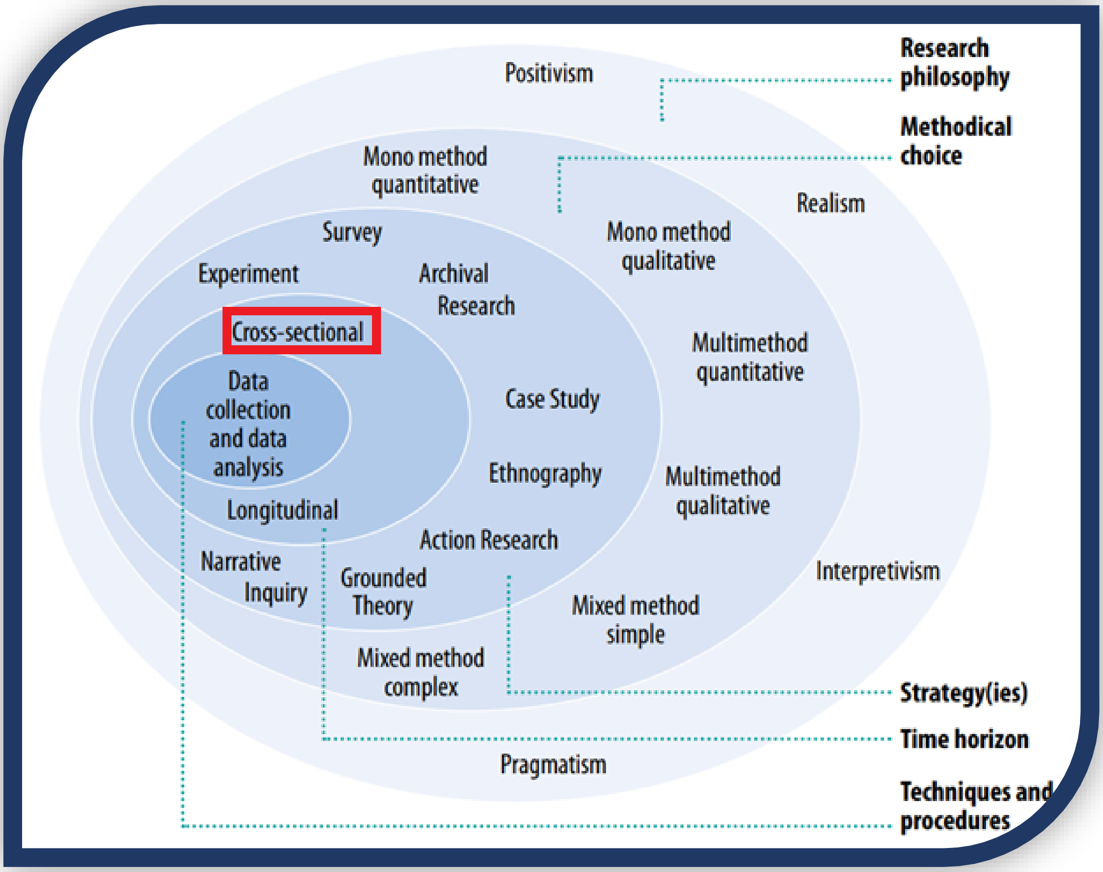


Figure 3.6. Time horizon for this study adapted from the research onion (Saunders, Lewis and Thornhill 2016)

3.9 Data collection for qualitative approach

Data collection for this study involved three phases, namely interviews, focus groups and the survey (Figure 3.7). Focus group discussions were conducted with students only and interviews were conducted with the rest of the stakeholders. The quantitative approach to this study involved a survey, through which data was gathered from learners in universities in Zimbabwe. The researcher investigated the same concepts based on the research questions for both the qualitative and quantitative data collections. Analysis of the data was done in three phases, upon completion of each data collection. The results were merged during data analysis.

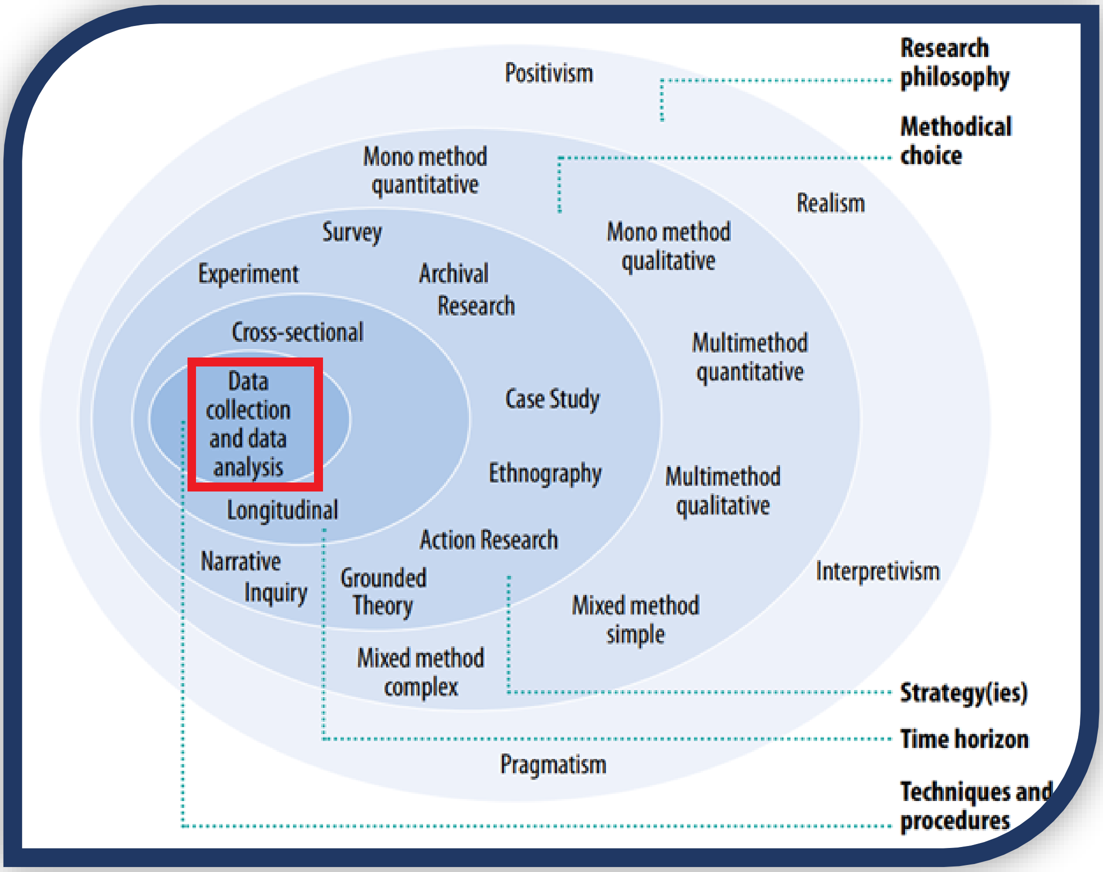


Figure 3.7. Techniques and procedures for this study adapted from the research onion (Saunders, Lewis and Thornhill 2016)

3.9.1 Conducting email interviews

Prior to conducting any data collection, permission was sought from the universities to conduct research. A sample of the letter sent to the institutions is in Appendix A. Conducting the interviews in person was a problem from the onset given that the participants and the researcher were in different continents. The researcher opted to conduct the interviews via Skype, and record the interviews. None of the potential participants was keen to do the Skype interviews, mainly due to having other time-competing obligations. This reason also ruled out telephone interviews. The researcher decided to conduct online, asynchronous interviews via email. In addition, the questions were available via an online link. Responses from the online link were automatically forwarded to the researcher. Participants therefore had options to either use the online link or respond via email. Some participants printed out the questions, answered them using a pen, scanned responses and sent them to the researcher.

Curasi (2001) suggests an initial email to participants to seek their agreement to participate in the study. In this study, the researcher sought agreement in the same email sent with the interview questions. This email contained the interview questions, the online link to the interview questions and an informed consent page. The latter explained the purpose of the study and what was expected of the participant. The informed consent form is in Appendix B. A copy of the email sent to the potential participants is in Appendix C, with the name of the participants removed to protect the potential participant's privacy. The interview questions for the interviews for the different participants are presented in Appendix D. The option of a single email was considered a better approach in this study because the researcher, being Zimbabwean, understood the culture and how people generally respond to unsolicited email. The researcher felt that potential participants would decide whether to participate based on one email, rather than an exchange of emails. An exchange of emails would likely be perceived as time-consuming by participants. This proved to be true as participants either ignored the emails, or immediately participated or indicated they would participate.

3.9.2 Designing and implementing email interviews

Interviews are arguably the most widely employed method in qualitative studies. In qualitative studies, the interview is set up to maximise the reliability and validity of measurement of the key concepts since the researcher has a particular set of research questions to be investigated (Bryman 2016). The two main types of research interviews are unstructured interviews and semi-structured interviews. Structured interviews use questionnaires based on a predetermined identical set of questions, while semi-structured interviews are based on a set of themes with the researcher possibly asking key questions which may vary from interview to interview (Saunders, Lewis and Thornhill 2016). For this study, structured interviews were conducted.

3.9.3 Guidelines for conducting email interviews

The guidelines used for conducting the email interviews are shown in Table 3. 4.

Table 3. 4 Guidelines used in conduction email interviews

- Determine what questions will answer the research question(s) and follow-up probes (Rabionet 2011).
- Determine the recruitment strategies such as snowballing, individual solicitation, message boards and listservs (Bowden and Galindo-Gonzalez 2015). In this study individual solicitation was used.
- Determine who will be interviewed (Horton, Macve and Struyven 2004).
- Establish rapport. This could be done by introducing the researcher in the first email (Bowden and Galindo-Gonzalez 2015).
- Consider ethical issues such as confidentiality and informed consent (McCoyd and Kerson 2006; Whiting 2008; Bowden and Galindo-Gonzalez 2015). This was considered throughout the interviews.

3.9.3.1 Questions for Interview guide

To formulate questions for the interview guide, the researcher considered the research questions and the existing literature on m-learning. The concepts that needed to be addressed in order to address the research questions were noted as the interview topics. The interview questions were constructed under interview topics which was an iterative process. The pilot guide was assessed by the research supervisors. The interview questions were revised to come up with a final interview guide. Interviews were conducted with lecturers, library staff, IT support staff. The flowchart showing how the interview questions were formulated is presented in Figure 3.8.

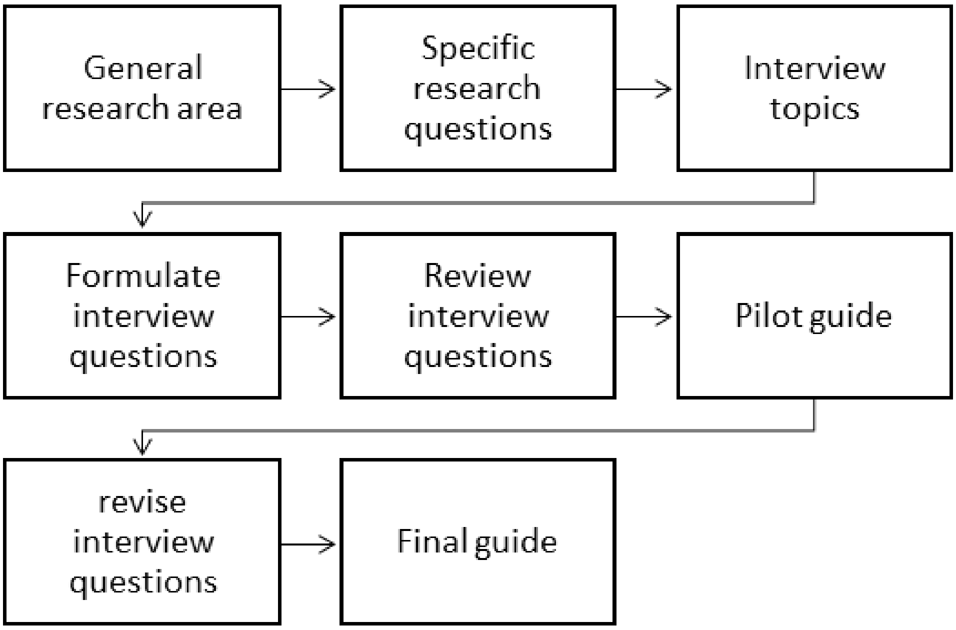


Figure 3.8. Flowchart showing how interview questions were formulated (prepared by researcher)

3.9.3.2 Sampling of interviews

Random sampling was used for the interviews. Participants were selected from five Zimbabwean universities. Methodological literature recommends continuing the data collection until it reaches saturation point; that is, when additional data provides no new information (Saunders, Lewis and Thornhill 2016; Ali and Yusof 2011; Carlsen and Glenton 2011). (Creswell 2013; Saunders 2012) recommend between 5-30 interviews, however Guest, Bunce, and Johnson (2006) note that 12 interviews are unlikely to be sufficient if the sample is heterogeneous. This study carried out the interviews considering the point of saturation. The research sample for the interviews is shown in Table 3. 5.

Table 3. 5 Interview research sample information (prepared by researcher)

Type of Respondent	Type of qualitative research	Quantity
Library staff	Semi-structured interview	Point of saturation
Faculty heads	Semi-structured interview	Point of saturation
Lecturers	Semi-structured interview	Point of saturation
University IT support staff	Semi-structured interview	Point of saturation

3.9.3.3 Advantages of email interviews

There were various advantages of using email interviews for this study, as shown in Table 3.6.

Table 3. 6 Advantages of email interviews

Costs, location and time
➢ The costs to administer email interviews were considerably less compared to telephone or face-to-face interviews (Meho 2006; Opdenakker 2006; Bowden and Galindo-Gonzalez 2015; Hawkins 2018). ➢ Email enabled the researcher to reach a wide variety of participants in the different geographical locations in Zimbabwe without making long-distance calls or travelling to these different locations, thus eliminating the boundaries of time and space (Bowden and Galindo-Gonzalez 2015; James 2016). ➢ Use of email assisted the researcher to reach participants particularly lecturers who would be very difficult to get hold because of busy schedules. ➢ There was no need of set appointments as participants could answer the questions at their own convenience and preferred familiar location. In addition, emails were sent to various participants at different times thereby allowing a number of interviews to occur simultaneously.

No pressure on participants
➢ It is likely that the removal of face-to-face interaction in some cases proved to be invaluable as participants were open to discuss in extensive detail. Email interviews prioritise the participants' comfortability this allowed participants to respond at their own convenience in familiar territory (McCoyd and Kerson 2006; Opdenakker 2006; Bowden and Galindo-Gonzalez 2015; James 2016; Hawkins 2018). ➢ Participants were empowered to present themselves in the way they chose, there was probably a sense of privacy and safety for participants as they responded behind screens.
Eliminating transcription issues
➢ A strength of email interviews for the researcher was that responses were already in text format, this obviated the need to transcribe. ➢ This consequently eliminated the costs of transcribing, removed transcription errors and saved the researcher time. Email interviews because they eliminate transcriber bias (Bowden and Galindo-Gonzalez 2015). ➢ With email interviews there are no linguistic pauses to deal with such as "you know", "ahh", "like"(Reid, Petocz and Gordon 2008). ➢ Email interviews greatly minimised editing and formatting of the data as would be in the case of face-to-face interviews, most participants did "clean-up" their responses.

3.9.3.4 Limitations of email interviews

However, the use of email interviews for this study was not without its limitations and challenges.

The three main limitations of email interviews in this study were:

- Creating rapport with participants (Bowden and Galindo-Gonzalez 2015; James 2016; Weller 2017)
- Limited responses (Hawkins 2018; Curasi 2001; Opdenakker 2006; Gibson 2010; Bowden and Galindo-Gonzalez 2015)
- Outdated details and delays(Bowden and Galindo-Gonzalez 2015; Hawkins 2018)

The limitations of using email interviews for this study are explored in detail in Table 3.7.

Table 3. 7 Limitations of email interviews in this study

Challenges creating rapport with participants ➢ Creating rapport with potential participants online was rather challenging, some participants abruptly stopped communication. ➢ In some cases, there were no responses from some of the potential participants. Follow-ups were made; in a few cases, this yielded positive responses. This corroborated the work of (Bowden and Galindo-Gonzalez 2015, James 2016, Weller 2017) who state that building rapport when there is no physical interaction can be stifled.
Limited responses ➢ In this study, there were instances where participants responded with one or two-word answers, when required to explain. Email interviews have the potential for short, concise answers and possible attrition as participants discontinue communication (Hawkins 2018, Curasi 2001). ➢ Email interviews greatly reduce the chances of spontaneous answers (Opdenakker 2006, Gibson 2010). Since participants have more time to reflect on the question this reduces opportunities to be spontaneous and yet spontaneity can be the basis of richness of data collected (Opdenakker 2006). The researcher believes that while the lack of spontaneous responses may be viewed in dim light for particular projects, in this particular study well thought out responses were likely to improve the research findings. The researcher contends that behaviour in responding to the questions will best address the research questions and thus benefit the study. ➢ Another shortcoming of email interview has to do with absence of physical interaction between the interviewer and the participants. The lack of social cues such as tone, hesitation or silence to demonstrate full understanding of participant's experiences when using email interviews may increase ambiguity and misinterpretations (Bowden and Galindo-Gonzalez 2015, Hawkins 2018). The data collected is therefore one-dimensional only text. There were no questions or seeking of clarification from the participants, so there was no room to demonstrate full understanding, which could be easily done if face-to-face interviews were conducted.
Outdated details and delayed responses Email interviews require participants to have Internet access and those participants should be computer literate. These requirements may marginalise participants (Bowden and Galindo-Gonzalez 2015, Hawkins 2018). Lecturers in Zimbabwe would be expected to be competent with computers, however Internet access is not guaranteed. ➢ A problem that arose in some cases were outdated email addresses. In some cases, the potential participants were no longer affiliated with the particular institution; however, the websites still publish the invalid email addresses. ➢ Another constraint when using email interviews is that the researcher may need to wait several days to receive responses from participants (Bowden and Galindo-Gonzalez 2015). This was true for this study some participants responded after a fortnight or longer, with some participants indicating that they did not check their email on a regular basis.

3.9.4 Designing and implementing focus group discussions

Focus groups are a formal way of interviewing a group of participants on a topic of interest. Focus groups are a group of individuals chosen and assembled by researchers to discuss and comment on the topic that is being researched from personal experience (Powell and Single 1996). Zorn et al. (2006), offer a broader definition describing focus groups as small groups (usually 6-12) of participants who are similar on some demographic dimension (e.g. age or social role) and who are brought together for the purpose of investigating their views on a particular issue. Focus group interviews involve particular themes to be explored in detail and how participants within the group discuss issues as members of that particular group (Bryman 2016). Focus group interviews are facilitated by a moderator, a topic is clearly defined with a focus on enabling and recording the interactive discussion amongst participants (Saunders, Lewis and Thornhill 2016). The focus group interviews for this study were conducted with tertiary students. The researcher sought the students' opinions about and perceptions of m-learning.

3.9.5 Focus group discussions

In order to create a comfortable environment, university rooms were selected as venues for the discussions. Each room was set up in such a way that participants were in a circular arrangement to encourage more interaction. The participants were encouraged to speak in the language with which they were most comfortable, and to interchange between the two main local languages, Ndebele and Shona, and English as the official language, depending on which language would best convey what they wanted to say. Refreshments were served to put participants at ease. Thereafter, the moderator introduced the questions one by one. The researcher, who could not be in attendance, listened to the focus groups' discussions via Skype and took notes. Two people assisted with the focus group discussions with one person being the moderator and the other person recording the discussions. The discussions were recorded using audio and video recording. The recorded responses were multi-dimensional, providing in additional to the narrative data, other aspects such as facial expressions and gestures.

3.9.6 Group membership and recruitment

It was important for this study to gather students who have some knowledge of m-learning. To avoid systematic biases in the selection process, a call for participation was issued to different classes (Powell and Single 1996). The contact details of potential participants were collected. The potential participants were contacted and briefed on the objective of the discussion. During the discussion, it was decided which of the potential participants would possibly provide the desired information. It was anticipated that some participants would not be available for the focus group discussions, so there was an over-recruitment with each group having 10 participants, in line with the suggestions of (Powell and Single 1996). Three groups were formed, each with ten members.

Group composition was neither completely heterogeneous nor homogeneous. There is a division of opinion among experts as to the characteristics of participants in a group. It is not always easy to identify appropriate focus group members since there are pros and cons of both heterogeneous and homogenous groups (Gibbs 1997). Ideal focus groups are neither excessively heterogeneous nor homogenous (Acocella 2012). The interviewer should assess and decide whether a heterogeneous or a homogeneous group will best achieve the objectives of the research (Dilshad and Latif 2013). Homogenous groups will produce information in greater depth because participants who share similar characteristics can identify with each other's experiences (Knodel 1993). However, heterogeneous focus groups with respect to educational background, knowledge, experiences are likely to adversely affect participants' willingness and confidence to express their viewpoints (Onwuegbuzie et al. 2009). Morgan (1996) is supportive of homogeneous groups arguing that participants with the same societal background such as educational background and age will have open and sincere discussions. The researcher decided to have homogeneous groups in terms of level of education, but with no further attempts to maintain homogeneity. The researcher anticipated that by having some level of heterogeneity in the groups, this would produce rich information and that the level of homogeneity would facilitate rapport. The time and location for the discussion was set, and the potential participants were informed they would receive SMS reminders of the time and location a day before the discussion.

3.9.7 Guidelines in conducting focus groups

The guidelines followed in conducting the focus group discussions were considered from three angles: the questions (Knodel 1993; Morgan 1996; Letts et al. 2007; Barbour 2008), participants (Knodel 1993; Brotherson 1994; Umaña-Taylor and Bámaca 2004; Powell and

Single 1996; Dilshad and Latif 2013) and moderator (Morgan 1996; Onwuegbuzie et al. 2009; Knodel 1993). These angles are discussed in Table 3. 8.

Table 3.8 Guidelines in conducting focus groups (prepared by researcher)

Angle	**Guidelines**
Questions	➢ Define and clarify the concepts to be investigated (Knodel 1993). ➢ Formulate questions as a set of discussion guidelines, that will be used by the moderator during focus group sessions (Knodel 1993; Morgan 1996) based on the concepts to be explored. ➢ Use of open-ended questions (Letts et al. 2007; Barbour 2008; Dilshad and Latif 2013). ➢ If focus groups are used to assist formulate questions for structured questionnaire, decisions on how many are contingent on the utility of the sessions as they are held (Knodel 1993)
Participants	➢ Identify selection criteria and select participants (Knodel 1993; Brotherson 1994; Morgan 1996; Umaña-Taylor and Bámaca 2004; Dilshad and Latif 2013). ➢ Consider ethical concerns in terms of privacy concerns given that what participants share with the researcher is inherently shared with the group (Morgan 1996). ➢ Informed consent, researchers should make it clear to participants how the discussion will be recorded and obtain each participant's agreement to the recording procedures (Powell and Single 1996).
Moderator	➢ Have a moderator, responsible for facilitating the discussion and encouraging members to speak as well as requesting talkative members to give others a chance to speak (Onwuegbuzie et al. 2009) ➢ Select a location to conduct the focus groups and how the sessions will be recorded (Brotherson 1994; Morgan 1996). ➢ To facilitate interaction moderators must create a comfortable environment that allows members to freely express themselves (Acocella 2012). ➢ Record the discussion with accuracy (Dilshad and Latif 2013). ➢ Determine the size and composition of groups (Morgan 1996; Dilshad and Latif 2013). ➢ Determine the number of groups based on point of saturation (Morgan 1996). ➢ Incentive for participation (Umaña-Taylor and Bámaca 2004; Morgan 1996) ➢ Employ a flexible approach suitable for exploratory studies, especially where researchers do not have substantial knowledge on the issues they wish to examine (Knodel 1993)

3.9.8 Questions for focus group guide

Designing the questions for the focus group was done in a similar way to that of the interviews (see Section 3.10.3.1). The focus group questions are presented in Appendix J. The same consent form used for email interviews was used for the focus group discussions. The consent form is shown in Appendix B.

3.9.9 Sampling focus groups

The participants for the focus group were selected using purposeful sampling which involves identifying and choosing individuals or groups of people who have particular knowledge or experience with the key concepts of the study (Clark and Creswell 2011). A focus group screener was used to recruit and select participants for the focus groups. It is important to interview the right people who can give relevant information. The learners selected to participate in the interviews had to have a clear understanding of m-learning in order for them to make meaningful contributions to the discussion.

Sample sizes in qualitative research should make it easy to extract thick, rich data and should therefore not be too large (Onwuegbuzie and Leech 2007). On the other hand, the sample should not be so small that it is difficult to achieve data saturation (Sandelowski 1995). Guidance on size of focus groups ranges between four and twelve participants (Kitzinger 1994; Morgan and Scannell 1998; Krueger 2014). For this study, the researcher decided to limit the size of the focus groups to 4-7 participants. The researcher felt that this size was small enough for everyone to have the chance to share insights, and large enough to provide a variety of opinions, but not too large to handle. The research sample for the focus groups is shown in Table 3. 9.

Table 3. 9 Focus groups research sample information – prepared by (researcher)

Type of Respondent	Type of Qualitative Research	Quantity	Type of Information to be obtained	Instrument
Students	Focus Group	Point of saturation	Perspective, Perceptions, Readiness, acceptance, attitude, factors	Focus Group guide

3.9.10 Benefits of focus groups

The main advantages of using focus groups for this study are given in Table 3.10.

Table 3. 10 Advantages of focus groups for this study (prepared by researcher)

Rich information ➢ Some of the learners engaged actively in the discussion groups enabling the researcher to gather rich information on how learners feel about m-learning and the learners' experiences thus far. ➢ The idea behind the use of focus groups is that the group process helps participants to explore and clarify their views in ways that would be less accessible using other means such as individual interviews (Kitzinger 1994; Acocella 2012). ➢ It was easier to ask learners to explain what they meant and have other learners argue against the ideas brought forth which led to rich information. Moreover, members of the focus group can build on ideas leading to more in-depth discussions of the topic (Letts et al. 2007). This was evident in the focus group discussions which enhanced the findings of this study.
Various Viewpoints ➢ Within one sitting it was easier to draw varying viewpoints from the group members of a focus group, which would have taken longer and more challenging using other methods (Umaña-Taylor and Bámaca 2004; Acocella 2012). ➢ Focus groups are particularly useful for obtaining in-depth information in new or understudied area (Umaña-Taylor and Bámaca 2004; Powell and Single 1996). Given the infancy of research on m-learning in Zimbabwe, focus groups provided an opportunity to get more detailed information from the learners beyond what could be obtained using surveys.
Thought process ➢ Focus group discussions provide insights into how participants process and make sense of information and enable the researcher to uncover participants' misconceptions and how the misconceptions arise (Barbour 2008). ➢ The focus group technique allows the researcher to develop an understanding about why people feel the way they do (Bryman 2016), which leads to in-depth understanding. Bryman (2016) further argues that conventional one-to-one interviews are rarely challenged which means participants might be inconsistent with their responses unlike focus groups were participants may argue or challenge each other's views. By so doing the researcher can end up with more realistic accounts of what people think about the phenomena that is being investigated.
Different types of communication Focus groups allow the researcher to tap into various forms of communication that people use in day-to-day interaction such as jokes, anecdotes, arguing and teasing (Kitzinger 1994). This was evident in this study, for example participants used a vernacular term "*zvimbudzi*" a word that has been adopted to describe basic mobile phones with no internet capabilities in Zimbabwe.
Developing survey items An additional strength of focus groups is that this approach can contribute to the creation of survey items by capturing the domains that need to be measured in the survey (Morgan 2011). This benefit was of value in this study as the findings of the focus group discussions greatly contributed to developing the survey questions.

3.9.11 Limitations of focus groups

Although focus groups are praised for their ability to obtain rich information from multiple perspectives, in a shorter time frame, this method of data collections does have its shortcomings. The limitations of focus group discussions for this study involved logistics (Bryman 2016; Lamb 2017) and transcribing (Mansell et al. 2004; Scott et al. 2009). These limitations are explored in Table 3. 11.

Table 3.11. Limitations of using focus groups for this study prepared by (researcher)

Logistical challenges A big challenge is organising focus groups. ➢ The process included recruiting the participants and securing their agreement. This was quite challenging as the recruitment required assistance from other people as the researcher could not travel to Zimbabwe. The researcher in efforts to be directly involved in the focus group discussions had a Skype calls with the moderator to enable the researcher to listen in and observe the focus groups. ➢ The Skype calls did not all go smoothly, at times the connection was lost. The first focus group only had an audio recording with the subsequent focus groups including video recording to capture gestures, facial expressions and any interesting aspects of the discussions. ➢ In this study some participants although having initially agreed to come for the focus group interviews failed to make it. ➢ It was evident that some participants even though they had agreed to participate during the focus group interviews they needed to be encouraged to contribute to the discussion. It was not clear whether these participants were just uncomfortable or just did not have the confidence to share their opinions. The study confirmed that focus group discussions are difficult to organise (Bryman 2016; Lamb 2017).
Transcribing Transcriptions are more difficult than in individual interviews, this was true for this study. Although some of the recordings had both audio and video recordings, transcribing was time-consuming because of variations in voice pitch and the need to accurately account which participant said what. In some cases, there were interjections which made transcribing even more challenging. Transcriptions in focus group discussions are more difficult compared to individual interviews (Mansell et al. 2004; Scott et al. 2009)

3.10 Data analysis for qualitative approach

Data analysis of data from the interviews and the focus groups was done separately but followed the same approach. Analysis started during data collection, with notes being made from that stage. Although the data analysis is documented as a sequential process, the analysis involved numerous iterations which were not linear.

3.10.1 Method of analysis

For the qualitative part of this study which comprised the email interviews and the focus group discussions, data analysis utilised the thematic analysis approach. Thematic analysis is a form of pattern recognition within the data where the developing themes become categories of analysis (Clarke and Braun 2013; Fereday and Muir-Cochrane 2006). The major advantages of thematic analyses are their flexibility and accessibility. Thematic analysis can be applied to a range of frameworks and does not require adherence to a particular theory of language or framework, and it is suitable for a wide range of research interests and theoretical perspectives (Clarke and Braun 2013). Thematic analysis is an iterative process which is grounded in six steps (Braun and Clarke 2006). While the steps are presented as a linear step-by-step procedure, the actual analysis is not linear but very iterative. The steps for thematic analysis are shown in Figure 3. 9.

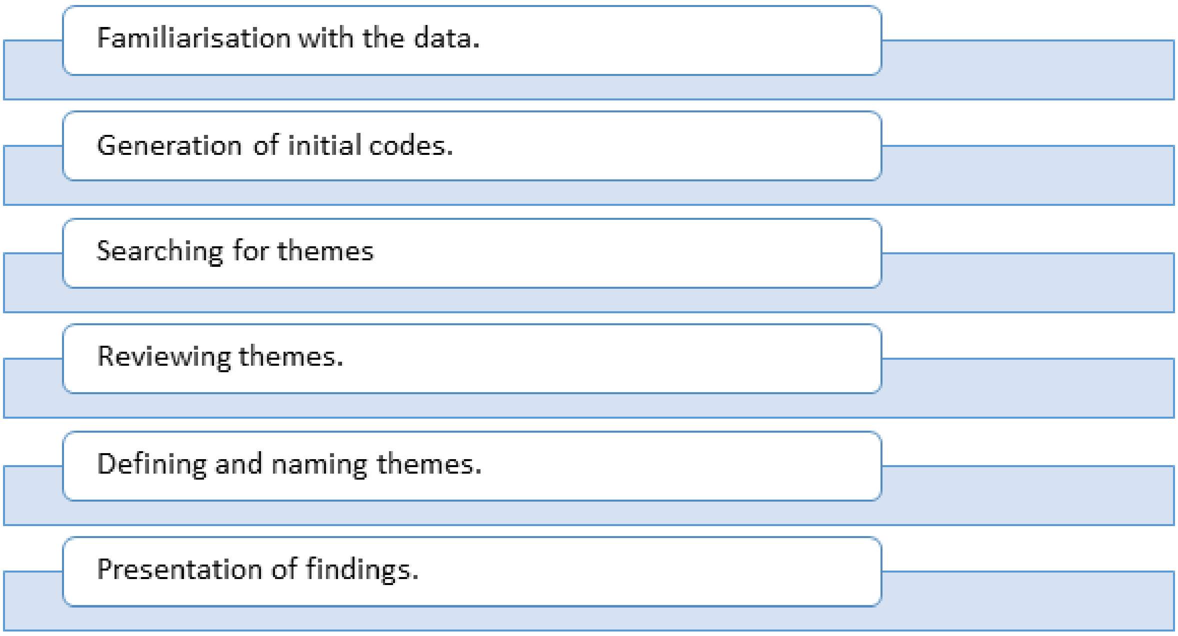


Figure 3.9. Thematic Analysis steps (Braun and Clarke 2006)

A hybrid approach was chosen for the thematic analysis. This incorporated the data-driven approach to the data collected, and the theory-driven approach. The deductive approach outlined by Boyatzis (1998) was appropriate for the research questions and interview questions, using predetermined codes based on key concepts in the theoretical construct. After the initial coding based on the research questions and interview questions, coding was data-driven. The transcripts were read carefully to find useful text relevant to the research topic. The units of text addressing the same issue were grouped together under categories and sub-categories. For some of the email interviews, NVivo 12 Pro software was used for coding. In some cases, where there were few participants, the researcher used manual coding as this was more efficient.

3.10.2 Validity of qualitative approach

The use of reliability and validity are common in quantitative research. Qualitative rigour is concerned with demonstrating confidence in the findings of the study as well as establishing the consistency of the study methods over time (Thomas and Magilvy 2011b). Some experts have redefined these terms so they can be applied to qualitative research. Validity and reliability have varying meanings depending on the different perspectives in qualitative research. The measures taken to ensure qualitative rigour were the same ones applied in the email interviews and the focus group discussions. With the qualitative approach, there are various ways to ensure validity. In this study, efforts were made to ensure qualitative rigour by applying measures suggested by other researchers to confirm confidence in the findings. The suggested measures are:

1. Appropriateness (Leung 2015; Flick 2018; Noble and Smith 2015).
2. Credibility (Ali and Yusof 2011; Janesick 1994; Thomas and Magilvy 2011a; Noble and Smith 2015).
3. Auditability (Noble and Smith 2015; Thomas and Magilvy 2011a).

These measures are discussed in Table 3.12.

Table 3. 12 Summary of measures taken to ensure validity in the qualitative approach (prepared by researcher)

Appropriateness Validity in qualitative research refers to the "appropriateness" of the tools, processes and data (Leung 2015; Flick 2018; Noble and Smith 2015). Validity examines whether the research question is appropriate for the desired outcome, as well as the methodology framework, sampling, data analysis and whether the results and conclusions are valid for the sample and context. To ensure the appropriateness of the tools, processes and data research, this was done with the assistance of three research supervisors. ➢ The research supervisors assessed if the research questions would produce the desired results as well as the appropriateness of the tools, processes and data in early stages of this study. ➢ Throughout the research the researcher consulted with the research supervisors to ensure the techniques employed and data collection methods were suitable.
Credibility For most positivists' internal validity, external validity and generalisation are the criteria for true research (Ali and Yusof 2011). The notion of the trinity of validity, reliability and generalisation should be applied to all research (Janesick 1994). Credibility is similar to internal validity (Thomas and Magilvy 2011; Noble and Smith 2015). Credibility is achieved by reviewing individual transcripts and looking for similarities within and across participants (Thomas and Magilvy 2011). ➢ For this study the transcripts were studied in detail before analysing. ➢ After familiarising with the interview contents, the researcher looked for similarities and differences across the email interviews. The same was done for the focus groups looking for similarities and differences within a group and across groups.
Auditability Strategies to strengthen credibility include reflexivity and use of participants' words in writing the report (Thomas and Magilvy 2011). Elements to strengthen credibility beyond reflexivity and reflection such as auditability of the research process, include verbatim descriptions of participants' responses, demonstrating clarity of the thought processes during data analysis and interpretation of findings (Noble and Smith 2015). For both email interviews and the focus groups some of the participants' responses were included verbatim in the findings.

3.10.3 Reliability of qualitative approach

Qualitative research can achieve applicable levels of external reliability by explaining the methodological framework and the different strategies employed in the study (Morgan and Drury 2003). This would include how participants were selected, the researcher's role and the perceived relationship with participants. The definition of reliability in qualitative research is challenging given the diverse paradigms, and that the essence of reliability in qualitative studies lies in consistency (Leung 2015). In order to ensure the rigour and quality of the qualitative approach in terms of reliability, the following measures were implemented:

- The methodology framework used in the qualitative approach was described, and included the sampling techniques, data collection process, and how the data was analysed and interpreted.
- Audio and video tapes were used to record the group discussions to ensure it was clear who was speaking, and notes were also taken during the focus group discussions.
- A moderator and another person were present in the room to take notes and do the recordings which would be useful for transcribing as suggested by (Kidd and Parshall 2000).

3.11 Data collection quantitative approach

A letter was sent out to students requesting them to participate in the survey. The letter was attached to the survey. The letter is presented in Appendix E. The survey questions are presented in Appendix K. The survey was carried out using self-administered questionnaires that required the participants to answer a series of questions. Self-administered questionnaires come in various forms, two of which were used for this study: the online (Web) survey, and the delivery and collection mode (Bryman 2016; Saunders, Lewis and Thornhill 2016). Self-administered surveys require distribution only. For the online survey, potential participants were invited to visit a website where the questionnaire would be found and could be completed. The questionnaire hyperlink was sent via email and social media platforms namely Facebook, Instagram, Twitter and WhatsApp. The online survey was designed to be completed on desktop computers, laptops as well as other mobile devices. The delivery and collection mode involved giving the participants a hard copy of the survey and collecting it after all questions had been answered. The paper-based and Web-based version of the questionnaire contained identical items in terms of questions, wording and sequence.

The online survey was partially successful. Participants bemoaned the cost of Internet data bundles, and the length of the questionnaire further increased the costs. Although 219 participants looked at the online survey, only 60 completed the questionnaire. Participants seemed eager to participate in the online survey, although most did not complete the questionnaire. This was largely attributed to the cost students would incur buying data bundles for Internet connectivity. The researcher switched to the paper-based mode to increase the response rate. The paper-based was more successful. This corroborates the work of Dillman et al. (2009) who suggested that a mixed-mode of data collection can increase the response rate.

3.11.1 Designing and implementing the survey

Questionnaires can be designed in a variety of ways. A good questionnaire should be able to collect relevant, necessary and sufficient data to answer the research questions (Ong 2012; Brace 2018). Saunders, Lewis, and Thornhill (2016), suggest three ways to design survey questions: (1) adopt questions used in other established questionnaires; (2) adapt questions used in other questionnaires; and (3) design new questions. The process of designing and developing the questionnaire involved three sources: (a) literature search, (b) findings of email interviews consisting of the different stakeholders that included 30 university lecturers, six university IT staff, eight university library staff and eight university faculty heads (c) findings of the three focus groups comprised of students from universities in Zimbabwe. The process which was iterative at the phase of pilot testing is depicted in Figure 3. 10.

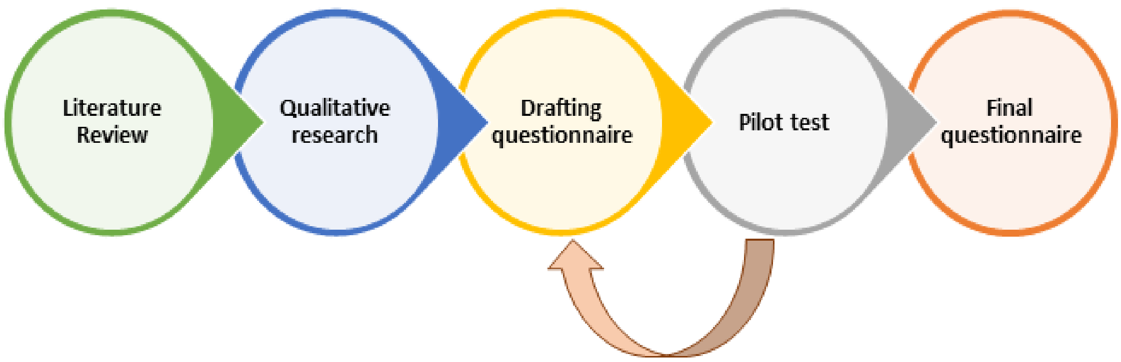


Figure 3.10. Process of designing the questionnaire (prepared by researcher)

3.11.1.1 Questionnaire style and appearance

The layout of a questionnaire can determine the response rate. Instead of making the questionnaire shorter, efforts in making an attractive layout is likely to enhance response rates Dillman, Smyth, and Christian (2016). Clear presentation facilitates the answering of all questions by using a variety of print styles, font sizes, italics to enhance the appearance of the questionnaire (Dillman, Smyth and Christian 2016; Saunders, Lewis and Thornhill 2016). The clarity of the questionnaire has direct impact on data collected by the interviewer and responses given by participants (Kazi and Khalid 2012). For this study, the researcher applied the suggested methods to improve the appearance of the questionnaire and made it easier to read and more appealing. This resulted in a bulkier questionnaire, although the participants found it easy to complete because of the layout as was reported during the pilot testing.

3.11.1.2 Clear instruction on how to respond

Clear instructions make it easier for potential participants to answer the questions. Instructions should make it clear to the participants whether they should tick, circle or underline the appropriate answer (Bryman 2016). If it is feasible for the respondent to select more than one answer, this should be stated. If not clearly explained, such cases may leave the participant unsure about how to respond or force the respondent to make inappropriate selections. The instructions on how to complete the survey were provided to participants.

3.11.1.3 Cover letter

For self-administered surveys, it is important to have a cover letter. A cover letter explaining the purpose of the questionnaire and instructions was included at the beginning of the questionnaire (Brace 2018). The purpose of the cover letter was to alert respondents about the questionnaire and to furnish respondents with details of requested actions and why they were being recruited for this study. The cover letter also sought informed consent. Participants were furnished with details of the study, what it entailed and why it was being done. The participants were requested to make sure they understood what they were being asked to volunteer for, before they actually participated in the study.

3.11.1.4 Survey questions

The wording and structure of questions play an important role in the response rate. Poorly worded questions may be difficult to answer or may result in participants not responding accurately. In an effort to ensure participants answered accurately and to ensure the validity and reliability of this study's findings, the researcher took the measures presented in Table 3.13.

Table 3. 13 Measures taken to ensure validity and reliability of the questionnaires

Types of questions	Phrasing questions	Designing questions
➢ Questions must be determined by the data you need to collect (Brace 2018; Saunders, Lewis and Thornhill 2016) ➢ Questions should be simple, clear and easy to understand avoiding technical terms and jargon (Kazi and Khalid 2012; Krosnick and Presser 2018). ➢ Careful consideration for how the questions are phrased is of essence to ensure that the responses are valid (Saunders, Lewis and Thornhill 2016) ➢ A prerequisite for obtaining reliable and valid data is by asking questions that are easily understood and consistently understood by all respondents (Lenzner 2012).	➢ Wording of the question should consider appropriateness of the content, level of language sophistication and sequence (Kazi and Khalid 2012). ➢ If respondents feel challenged by the words and phrases used, they may make little effort to respond accurately (Brace 2018). ➢ The language of the questionnaire should be at the level of understanding of the participants. ➢ Survey questions should be unambiguous and should require little processing time (Lenzner 2012). Ambiguity in self-administered questionnaires can make it impossible for the respondent to know how to answer (Brace 2018). To safeguard against poor wording and phrasing, and to remove ambiguity in the questions the researcher sought the assistance of a professional editor.	➢ Designing questions for a survey can be challenging. Valuable advice in common wisdom when it comes to designing questionnaires (Krosnick and Presser 2018). ➢ This summary echoes the same points raised by (Allery 2016; Singh, Suppakitpaisarn and Osothongs 2016; Saris and Gallhofer 2014) ➢ These points were taken into consideration when designing questions for this study. This includes word use, how to phrase questions, what to avoid and how to make response options exhaustive and mutually exclusive.

The sequence of questions is important. The general rule is to place the more general questions before the specific questions (Lietz 2010). Krosnick and Presser (2018) offer advice on conventional wisdom to optimise question order. This touches on where questions should be placed in the questionnaire, how questions on the same topic should be asked and grouped, and the importance of including filter questions. For this study, there were no questions that were deemed sensitive and there were no filter questions; the researcher took into consideration the advice. The six points discussed are depicted in Figure 3.11.

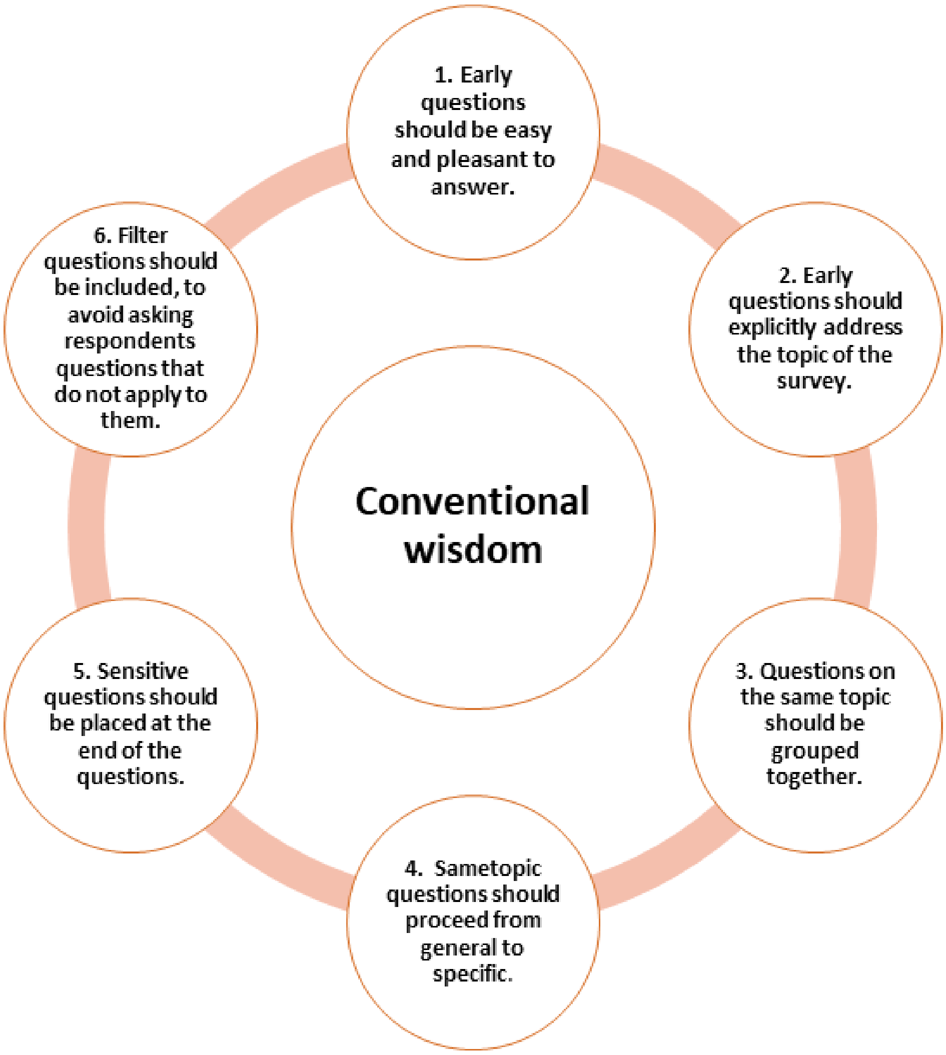


Figure 3.11. conventional wisdom on optimising question order in a questionnaire adapted from (Krosnick and Presser 2018) (prepared by researcher)

3.11.1.5 Questionnaire validity

The questionnaire was tested for validity. Testing a questionnaire for validity asks whether the questions posed address the objectives of the study and checks to ensure that there are no errors in the questionnaire (Brace 2018). The research supervisors checked to ensure that the questions being asked were relevant to the research objectives. In addition, the supervisors checked for errors, and the necessary amendments were made. Given the time and budget constraints, informal pilots were carried out with a small number of fellow students who met the eligibility criteria as recommended by (Brace 2018). Pretesting a questionnaire is recommended in questionnaire construction as this can be of assistance for specific wording choices and question orderings (Krosnick and Presser 2018). The informal pilot gave an indication of how long it would take to complete the survey and the feedback helped improve the final questionnaire.

3.11.2 Sampling of survey participants

From the chosen five universities, purposive sampling was used to select personnel from departments within the different faculties who would best answer the research questions and meet research objectives; this was followed by random sampling to select individual participants. The sample size for the survey was calculated using the formula provided by Yamane (1967) which is widely used for calculating sample sizes. This is given below:

$$n = \frac{N}{1 + N(e)^2}$$

N= population size, e= level of precision and n= sample size. At 95% confidence level, with P=0.05 to calculate the sample size n, given the population (N) =48286, and e=0.05

$n =$ $\underline{48286}$

$1+ 48286\ (0.05)^2$

$n= 396.713$

With a population of 48286 students, the sample size would have to be 397. The sample size for each institution was calculated proportionally as: (student population of institution)/ (the total student population of the 5 universities) * the sample size.

It was anticipated that the online survey would be a mixed-device survey allowing participants to complete the survey on a range of devices such as PCs, laptops, mobile phones and tablets. It was anticipated that high density of mobile phone ownership would make mobile phones the device of choice.

3.11.3 Advantages of online surveys

A key advantage of online surveys is flexibility as a result of technological advances. The availability of online survey programs provide flexibility in terms of design options for the questionnaire which can prevent participants from inadvertently not answering all questions, question format, response categories and restricting/eliminating invalid responses (Bryman 2016; Fan and Yan 2010; Evans and Mathur 2018). The online survey program used for the survey was Qualtrics online survey software, which allowed flexibility and the tracking of responses. Survey protection settings in Qualtrics software were used to prevent participants from answering a questionnaire more than once.

Arguments for online surveys emphasize cost benefits, fast data collection, flexibility and wide coverage (Evans and Mathur 2018). Online surveys tend to have a faster response rate with fewer unanswered questions (Bryman 2016). Another strength of online surveys is that participants' responses can be automatically programmed to download into a database which eliminates the daunting task of coding large numbers of questionnaires (Bryman 2016; Fan and Yan 2010). However, most participants bemoaned the cost of the Internet bundles required to complete the survey. In this study, online surveys were cheaper for the researcher, although it was an expensive exercise for the participants. Qualtrics proved to be a time saver and great benefit for the researcher as there was no need to enter or code data from the questionnaires; however, only a small fraction of the participants completed the survey online due to cost constraints.

3.11.4 Disadvantages of online surveys

A major disadvantage of online surveys is the low response rate (Bryman 2016; Couper and Miller 2008; Fan and Yan 2010; Scott et al. 2011; McPeake, Bateson and O'Neill 2014; Evans and Mathur 2018; Hohwü et al. 2013). The Qualtrics survey software indicated that a handful of completed questionnaires were collected, which supports literature that response rates are low with online surveys. Another limitation of online surveys is that they are restricted to online populations; thus, they do not cater for disadvantaged participants with poor or no Internet access (Bryman 2016; Fan and Yan 2010; Heiervang and Goodman 2011). Although the Internet access is available in Zimbabwe, most students were limited by Internet costs, and so most could not participate in the online survey.

Online surveys require motivation; if participants have to pay for the Internet connection, they will need a higher level of motivation (Bryman 2016). The length of a survey has a negative linear relationship with response rate, meaning that the longer the survey, the less likely that participants are going to complete the survey (Walston, Lissitz and Rudner 2006; Galesic and Bosnjak 2009). Several potential participants reported that the survey was too long. In addition, the need to pay for the Internet made it difficult for these participants to assist with the survey as it was expensive for them.

There are suggestions that low response rates continue to be a concern with online surveys. A study by Scott et al. (2011) in Australia on survey response rate with different modes of survey administration, showed that the online mode had the lowest response rate and lower completion rates in different sections of the survey. Giving potential participants a choice of mode with online surveys does not appear to increase the overall response rate, citing that even in countries like the USA substantial proportions of the population remain without Internet access (Couper and Miller 2008). Table 3.14 shows the factors that contribute to a low response rate according to (McPeake, Bateson and O'Neill 2014; Fan and Yan 2010).

Table 3. 14 Factors that contribute to a low response rate

- Survey length
- Familiarity and trust with Internet
- Reliability of access to Internet-particularly in remote locations
- Participants may be less comfortable with online surveys
- Paper-copy may be more portable and can be completed at leisure.

In this study, the survey length was mentioned as a reason for the poor response rate as most learners needed to pay for Internet access. Learners felt the length of the survey made it costly for them to participate. Some learners did not have access to Wi-Fi, which made it difficult to complete the questionnaire. The cost of Internet access was a major hindrance also contributing to the poor response rate.

3.11.5 Advantages of paper-based Survey

A major advantage of paper-based surveys over online surveys is that they can achieve higher response rates (McMaster et al. 2017; Hohwü et al. 2013). In this study, participants seemed eager to complete the online survey but were prohibited by Internet access. Similarly, a study by Nitikman, Mulpuri, and Reilly (2017) showed that a majority of participants in their study preferred Internet-based questionnaires to paper-based ones. According to Campbell et al. (2014), in developing countries, paper-based surveys remain prevalent because of two factors: (1) limited computer and Internet access, and (2) online surveys have much higher fixed costs. Computer-aided surveys have some unique challenges in low and middle-income countries which may be resource-constrained (van Heerden et al. 2014). Online surveys would be more suited to controlled environments that are electrified and with wired broadband which may not be widely available in some emerging economies (van Heerden et al. 2014). The paper-based survey was selected after little success with the online survey. The paper-based survey meant that the study was not limited to respondents with Internet access and was not affected by intermittent power supplies which greatly affect Internet access. To ensure participants did not complete the survey more than once, they were asked whether they had completed the online version or the paper-based version. Because it would be difficult to verify the answers, it was deemed that the participants would be truthful in this regard.

3.11.6 Disadvantages of paper-based survey

The cost of a paper-based survey may be double that of a web questionnaire, with the online survey being more advantageous in terms of logistics (Hohwü et al. 2013). Unlike the online survey which was cheaper for the researcher and more expensive for the participants, the paper-based survey proved to be expensive for the researcher and cheaper for the participants. The researcher incurred the costs of printing as well as delivering and collecting the questionnaires. For this study, the paper-based survey proved to be invaluable as the success of the quantitative approach relied heavily on this rather than on the online survey. Online surveys continue to be attractive and are gaining widespread use; however, they are a viable tool in areas that have the requisite infrastructure including reliable power supplies and reliable and affordable Internet access.

3.11.7 Likert scale

The Likert scale was used to measure opinions which consisted of a series of statements. Participants had to indicate their degree of agreement or disagreement. This study employed a five-point scale anchored by: strongly agree, agree, neither agree nor disagree, disagree, strongly disagree. The Likert scale can also be designed with seven-points or nine points. The five-point scale was chosen in order to increase the response rate and response quality while reducing respondents' frustration (Babakus and Mangold 1992). The five-point scale is recommended because it yields data of higher quality compared to the other scales Revilla, Saris, and Krosnick (2014). Based on actual research work on which scale to use and the recommendations of Revilla, Saris, and Krosnick (2014), the researcher determined the five-point scale as most appropriate for this study.

3.12 Data analysis for quantitative approach

Data analysis for the quantitative approach considered descriptive statistics, and the statistical technique exploratory factor analysis (EFA) was employed to reduce the data. Descriptive statistics provided details of the demographics of the surveyed participants. Demographics are those characteristics of the research participants which ensure the relevance of the data collected (Saunders, Lewis and Thornhill 2016). Some studies suggest that demographic variable are related to attitudes towards technology adoption Rojas-Méndez, Parasuraman, and Papadopoulos (2017).

3.13 Exploratory factor analysis (EFA)

EFA helps the researcher determine the number of latent constructs underlying a set of variables and provides a means of explaining variation among the variables using newly created factors (Suhr 2006; Osborne 2015; Yong and Pearce 2013). The EFA followed the five-step factor analysis guide proposed by (Williams, Onsman and Brown 2010).

3.13.1 Step 1: Is data suitable for factor analysis?

The literature shows that there are various views regarding sample size and guidelines. Strict rules regarding sample size for EFA have disappeared (Costello and Osborne 2005). Some studies have shown that an adequate sample size is determined by the nature of the data (Fabrigar et al. 1999; MacCallum et al. 1999). Generally, "stronger data" would still produce an accurate analysis with a small sample size; "strong data" in factor analysis means data with uniformly high communalities, no cross loadings, and high loadings on each factor. However, this is rarely the case (Costello and Osborne 2005).

A sample size of 200 is recommended for consistent recovery of factors (Guilford 1954). A minimum of 100 cases is suitable for factor analysis (Hair et al. 1995). Tabachnick's rule of thumb recommends at least 300 cases for factor analysis Tabachnick, Fidell, and Ullman (2007). A number of textbooks (Pett, Lackey and Sullivan 2003; Gorsuch 1983; Tabachnick, Fidell and Ullman 2007) mention the work of Comrey and Lee in their guides for sample sizes 100 =poor, 200 =fair, 300 =good, 500 =very good and 1000 or more= excellent. More recently, participant-to-variable ratios have been considered to be more useful for analysis with ratios ranging from 5:1 to 10:1 (Reio Jr and Shuck 2015; Costello and Osborne 2005). Research remains unclear about the ideal size of a sample. However, this study had 358 participants which can be considered an adequate sample size.

3.13.1.1. Data inspection techniques

There are a number of tests that can be used to assess the suitability of the collected data for factor analysis. The tests conducted on the data set for this study are discussed below.

3.13.1.2 Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy

The KMO index specifies how small the partial correlations are relative to the original correlations (Mvududu and Sink 2013). The KMO is an index that determines whether the components belong psychometrically and whether the correlation matrix is appropriate for factor analysis (Dziuban and Shirkey 1974). The KMO measure of sampling adequacy is an indicator that latent factors may be present and EFA may be performed. The KMO measure of sampling adequacy lies between 0 and 1 (Howard 2016). A value close to 1 indicates that correlations are relatively compact and therefore factor analysis should yield distinct and reliable factors (Field 2013).

Table 3.15 shows the evaluation values according to Kaiser (1974).

Table 3. 15 KMO evaluation values (Kaiser 1974)

KMO Measure	Evaluation
Below .5	unacceptable
In the .50s	miserable
In the .60s	mediocre
In the .70s	middling
In the.80s	meritorious
In the .90s	marvellous

In contrast to Kaiser (1974), a KMO value of 0.50 is considered suitable for factor analysis (Hair et al. 1995; Tabachnick, Fidell and Ullman 2007). Values above 0.9 are superb (Hutcheson and Sofroniou 1999). KMO values above 0.7 are generally well accepted.

3.13.1.3 The Bartlett's Test of sphericity

The Bartlett's test of sphericity examines whether the variables are largely uncorrelated (Mvududu and Sink 2013). The test checks whether the observed correlation matrix is an identity matrix holding the property of having all off-diagonal values of zero (Tobias and Carlson 1969). Since factor analysis explains relationships between variables within a data set, a complete lack of relationships within the data set prevents EFA from being conducted. The Bartlett's test of sphericity should be significant ($p < 0.05$) for factor analysis to be suitable (Hair et al. 1995; Tabachnick, Fidell and Ullman 2007).

3.13.1.4. Reliability of quantitative data

The rigour of research refers to the extent to which researchers work to enhance the quality of their work. In quantitative studies, this is achieved through the measurement of validity and reliability (Heale and Twycross 2015). Reliability is principally an issue with quantitative research (Bryman 2016). Reliability deals with the consistency or repeatability of the measure, and is the extent to which data collection technique(s) will yield consistent findings, similar to the observations or conclusions made by other researchers (Saunders, Lewis and Thornhill

2016). Reliability is a measurement within a construct, which reflects the internal consistency reliability among indicators of each construct. A participant completing an instrument to measure a specific construct should give approximately the same responses each time the test is completed. Reliability is about how well a set of instrument items selected for a given construct measures the same construct and is consistent on different occasions (Sabah 2016).

A reliability analysis of the questions in which EFA was conducted was carried out using Cronbach's alpha (α). Reliability is used to ensure the consistency of results of different variables being tested in each component (Field 2013). Reliability is normally evaluated by assessing the internal consistency of the items representing each construct using Cronbach's α (Cronbach 1951). de Winter, Dodou, and Wieringa (2009) demonstrate that high internal consistency is not necessary for good factor recovery, with Boyle (1991) offering more detailed discussions of how this occurs. Other researchers have offered recommended reliability levels based on the function of the research and whether the research is exploratory or applied. For basic research, the recommended level for Cronbach's α is .7-.8 (Kaplan and Saccuzzo 1982; Nunally and Bernstein 1978), with preliminary research the levels are set at .7 Nunally and Bernstein (1978) and Murphy and Davidshofer (1988) assert that a level below .6 is unacceptable, .7 is low, .8-.9 is labelled as moderate to high, and .9 is high.

3.13.1.5 Validity of quantitative data

Validity means that the researchers are measuring what they want to measure. This is concerned with whether the measure of a concept really measures that concept (Bryman 2016). Validity is concerned with congruence, or a 'goodness of fit' between the details of the research, the evidence, and the conclusions drawn by the researchers (Kalof, Dan and Dietz 2008). Validity is defined as the extent to which a concept is accurately measured in a quantitative study (Heale and Twycross 2015). Saunders, Lewis, and Thornhill (2016), define validity as: (1) the extent to which a data collection method(s) accurately measures what it was intended to measure; and (2) the extent to which research findings are really about what they profess to be about. There are a few tests a researcher can perform to ensure the validity of a study.

3.13.1.5.1 Content validity

Content validity refers to the extent to which the questions in the questionnaire provide adequate coverage of the research questions Saunders, Lewis, and Thornhill (2016). In this study, the operationalization of all the constructs was based on the existing literature, where they had been shown to exhibit strong content validity. In addition, the content of the questionnaires was reviewed by experienced researchers (research supervisors) to determine whether each of the questions in the questionnaires was essential, useful or unnecessary.

3.13.1.5.2 Construct validity

It is a concept first introduced by Cronbach and Meehl (1955) which deals with how well the selected instrument items for a given construct are a reasonable measurement of the construct. Construct validity evaluates the extent to which a set of questions actually measures the presence of the construct the researcher intended them to measure (Strauss and Smith 2009; Saunders, Lewis and Thornhill 2016). Construct validity encourages the researcher to derive hypotheses from a theory that is relevant to the concept Bryman (2016). The use of different measurement procedures in this study which involves interviews, focus groups and a survey to collect data about constructs will be used to establish construct validity. In this study, two different measurement procedures were considered separately: interviews and survey, and then the focus groups and survey.

3.13.2 Step 2: How will the factors be extracted?

Factors can be extracted in several ways. Williams, Onsman, and Brown (2010) provide a list of the most commonly used methods. These are shown in Table 3. 16.

Table 3. 16 Methods for extracting factors (Williams, Onsman and Brown 2010)

- Principal components analysis (PCA)
- Principal axis factoring (PAF)
- Maximum likelihood
- Unweighted least squares
- Generalised least squares
- Alpha factoring
- Image factoring

The PCA and PAF are the most commonly used methods, according to the literature (Tabachnick, Fidell and Ullman 2007; Izquierdo Alfaro, Olea Díaz and Abad 2014). In some textbooks and publications, it is not always clear which method of factor extraction was employed and whether the extraction method is available in the software package the researcher used (Costello and Osborne 2005). Costello and Osborne (2005) suggest that quite possibly

PCA has become popular because it is a default in some software packages, coupled with the difficulty of choosing a method from the several available ones.

3.13.3 Step 3: What criteria will assist in determining factor extraction?

The rationale behind data extraction is to reduce a large number of variables to a much smaller number of factors. Various criteria can be applied to both produce scale unidimensionality (the extent to which the scale measures one underlying factor) and to simplify factor solutions (Williams, Onsman and Brown 2010). Given the wide choice and rather confusing nature of factor analysis, it is recommended that multiple criteria be used (Costello and Osborne 2005; Thompson and Daniel 1996; Hair et al. 1995). Extraction approaches and tests include Kaiser's criteria (eigenvalue > 1 rule) (Kaiser 1960), the Scree test (Cattell 1966), the cumulative percent of variance extracted, and parallel analysis (O'connor 2000), interpretability criteria which checks the following (Suhr 2006, 3):

1. Are there at least three items with significant loadings (>0.30)?
2. Do the variables that load on a factor share some conceptual meaning?
3. Do the variables that load on different factors seem to measure different constructs?
4. Does the rotated factor pattern demonstrate simple structure?

The researcher needs to decide whether a cross-loading item should be dropped, which could be a good choice if there are adequate strong loaders greater than .50 (Costello and Osborne 2005). Factor analysis serves to isolate items with high loadings and simultaneously find factors that, taken together, explain the responses (Williams, Onsman and Brown 2010). In this study, the researcher used multiple criteria for factor extraction to determine which were the most appropriate to yield a simple structure.

3.13.4 Step 4: Selection of rotational method

Factors are rotated for better understanding because unrotated factors are ambiguous. Better understanding is achieved by maximising high item loadings and minimising low item loadings (Rummel 1970). Rotation aims to produce a simple structure by having each factor define clear clusters of interrelated variables to make interpretation easier. Attempting to discover the simplest method of interpretation of observed data is known as parsimony, and this is essentially the aim of factor analysis (Harman 1976).

The two common rotation techniques are: orthogonal rotation and oblique rotation. Researchers can select from a variety of methods offered by the two techniques. Under orthogonal techniques, a researcher can opt for any of the following: Varimax, quartimax, and equamax. Oblique rotation offers the following methods direct oblimin, quartimin, and promax. Orthogonal techniques produce factors that are uncorrelated, while the oblique technique produces correlated factors.

Conventional wisdom that applies the orthogonal technique for easier interpretation of results is flawed given that if factors are truly unrelated, both the oblique rotation and orthogonal techniques should produce similar results (Costello and Osborne 2005). The main objective of rotation is to provide easier interpretation of results and produce a solution that is more parsimonious regardless of the technique used (Hair et al. 1995). The rotated solution that produces the best fit and factorial suitability both intuitively and conceptually should be used (Williams, Onsman and Brown 2010). The researcher has to decide whether to discard items that do not load or cannot be assigned to a factor based on the guides discussed earlier (Williams, Onsman and Brown 2010). The orthogonal rotation was deemed most appropriate for this study.

3.13.5 Step 5: Interpretation

Interpretation involves examining the variables attributed to a factor and giving the factor a label. Interpretation also involves decisions about the minimum threshold for factor loadings (Reio Jr and Shuck 2015). Naming of a factor should be done in a manner that represents the conceptual meaning of each variable, defining a particular latent dimension (Mvududu and Sink 2013). Naming factors is rather subjective but the names should reflect the theoretical and conceptual intent (Williams, Onsman and Brown 2010). The application of the steps in this study is explained in chapter 6.

A summary of the EFA steps is shown in Figure 3.12.

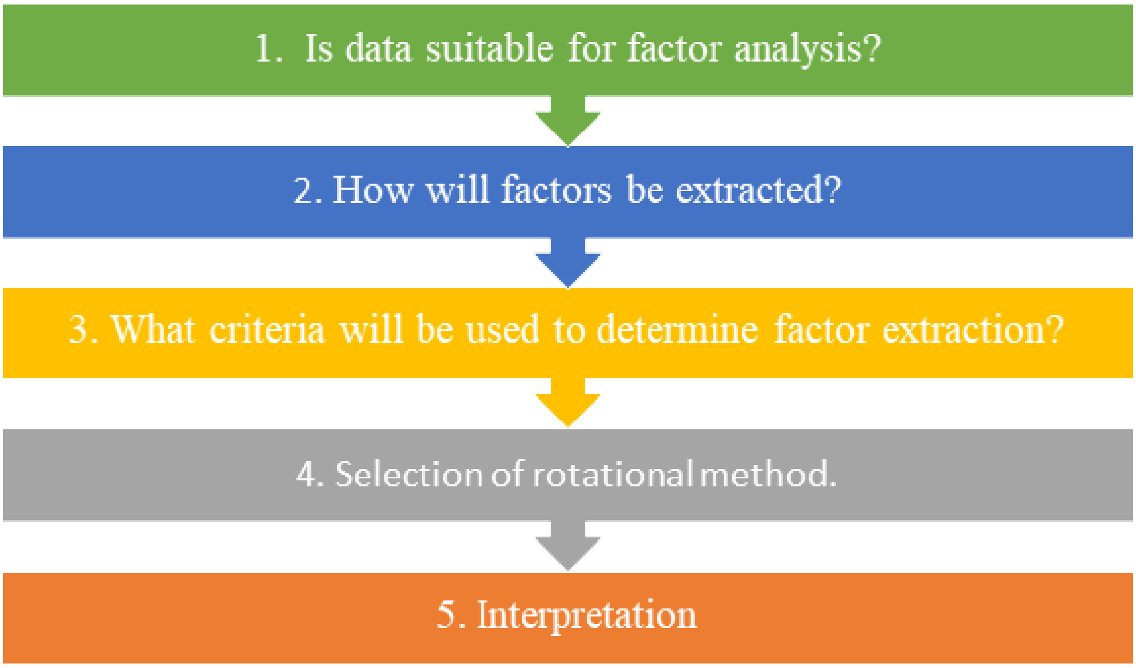


Figure 3.12. Summary of the EFA steps (prepared by researcher)

A diagrammatic summary of the research methodology model used for this study, with the specific aspects applied to this study, is shown in Figure 3. 13.

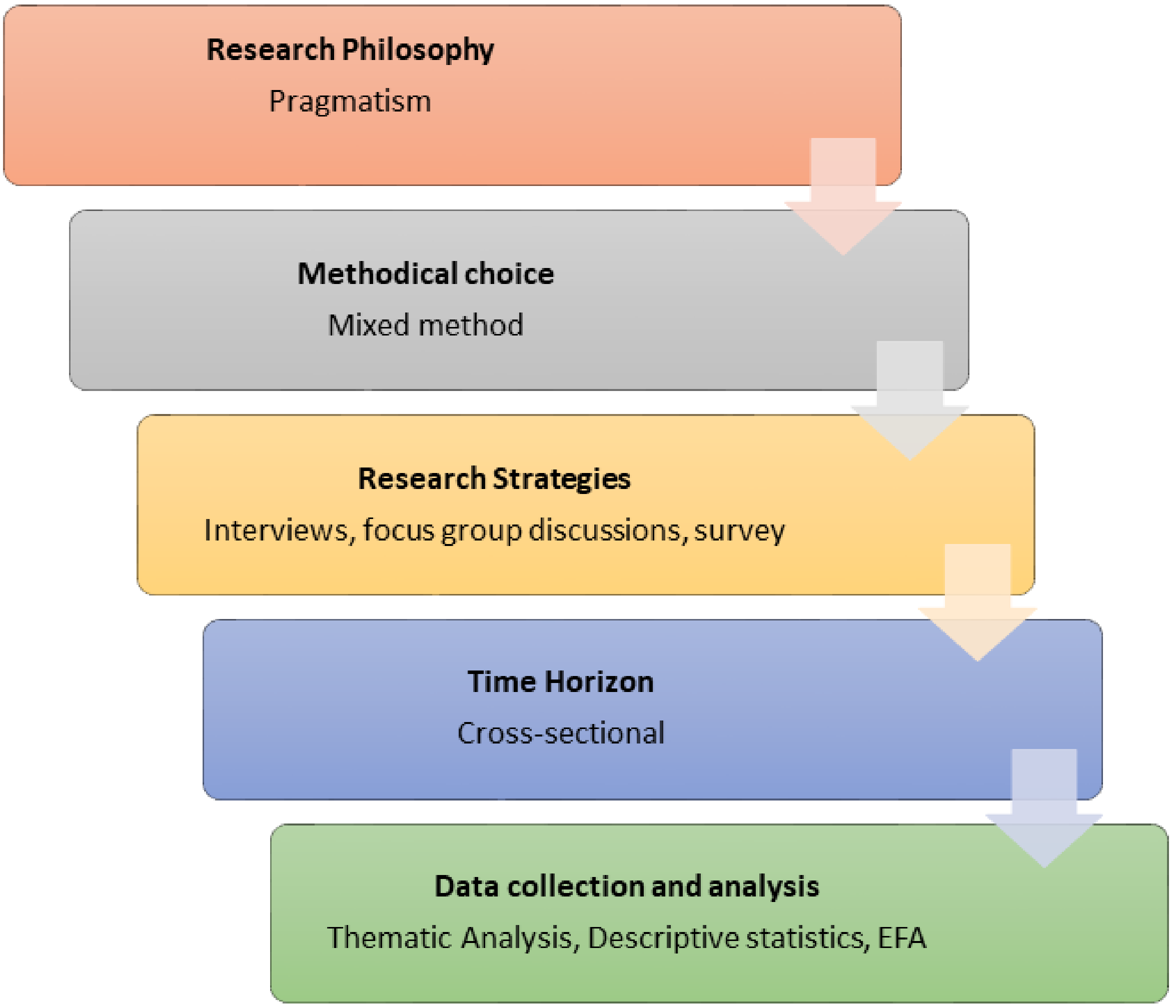


Figure 3.13. Summary of the research methodology model used for this study (prepared by researcher)

3.14 Data management

All data collected from email interviews, focus group discussions and the survey were stored in electronic format on the university's R drive for seven years from when the thesis is submitted. Physical data sheets are stored in a filing cabinet in the principal investigator's office. In addition, there will be an increased security level to protect the research data through password protection and only the researcher and supervisors have access to the data. Regular backups were done as a safeguarding measure. The dissemination of this data will be via journal articles, conferences, and book chapters only.

3.15 Ethical considerations

Ethical issues arise at different stages in research. Before carrying out the research project, ethical issues should be taken into consideration (Saunders, Lewis and Thornhill 2016). Most tertiary institutions have ethics committees that issue guidelines about ethical practice in research work. The guidelines provide indications of what are considered ethically unacceptable practices (Bryman 2016). In line with Curtin University's policy, and because the study involves human participants, the researcher sought approval from the university's Human Research Ethics Committee. The ethics application forms (low risk) were submitted before proceeding with the data collection. Research instruments for the study were prepared and submitted to the Ethics Committee for approval. The researcher sought separate ethical approval for the email interviews, focus group interviews and the online survey.

Since data collection was conducted in Zimbabwe, in line with requirements of some of the institutions, the researcher also obtained permission from these Zimbabwe institutions before commencement of the study. Ethical issues in research are mostly concerned with falling short of the ethical principles. Diener and Crandall (1978), claim that transgressions of ethical principles revolve around four main areas namely: (1) Whether there is *harm to participants;* (2) whether there is *a lack of informed consent;* (3) whether there is an *invasion of privacy* (4) whether *deception* is involved.

3.15.1 Harm to participants

Harm can occur in different forms: physical harm, harm to participants' development, stress and loss of self-esteem (Bryman 2016). Participants were given an information sheet which discussed the details of the projects as well as anticipated risks, side-effects, discomfort or inconveniences of participating in this study. There were no foreseeable risks form this study and participants were only expected to give up some of their time by participating in this study. It was clearly indicated that if a participant felt uncomfortable answering any of the questions, the participants could disregard the question(s).

3.15.2 Lack of informed consent

Informed consent is consent given by research participants to take part in a research project based on adequate information about the nature and purposes of the research (Walliman 2017).

Researchers should ensure that participants are fully aware of what they are getting into so that they can make an informed decision of whether or not to participate (Williamson 2007; Bryman 2016; Kalof, Dan and Dietz 2008). Participation should be voluntary, the goals of the research, risks and benefits for participating should be clearly conveyed to potential participants (Kalof, Dan and Dietz 2008; Flick 2009). A standard method for letting participants know about the research is to use an informed consent sheet (Aluwihare-Samaranayake 2012). An informed consent sheet gives details on the purpose of the research, the duration of the study, nature of involvement and how confidentiality of the participants' contributions will be ensured (Williamson 2007). Consent sheets was used in this study. Table 3.17 outlines how informed consent was sought for this study.

Table 3. 17 How informed consent was sought for this study

Data collection method	**How informed consent was sought**
Email interviews	Consent sought via initial email.
Focus group discussions	Consent form provided before focus group discussions.
Online survey	Consent form placed before survey questions.
Paper-based survey	Consent sheet attached at the beginning of the survey.

3.15.3 Invasion of privacy

A study should be designed so that privacy is protected. In research, privacy of the research subjects should be respected rigorously (Kalof, Dan and Dietz 2008). Standards of privacy and confidentiality serve to protect access, control and dissemination of personal information. When conducting research, the privacy of research participants is respected when participants are given opportunities to control what personal information is disclosed or withheld (McCormack et al. 2012). For the quantitative phase of this study, no personal information was collected.

The issues of privacy are linked to issues of anonymity and confidentiality. This can be more challenging with qualitative approaches. In qualitative research, it is critical that participants feel that their privacy will be adequately protected and that any risk or harm will be minimised to a level acceptable to them (James and Busher 2006). In this study, the qualitative approach was used for email interviews and focus groups. Both groups of participants were made to feel safe about disclosing their opinions and experiences by assuring them of anonymity. The participants were assured that implicit or explicit links between the information they provided, and their names would not be used. In the reports where any information was quoted verbatim, codes would be used to identify the participants, not their real names.

3.15.4 Deception

Deception occurs when researchers represent their work as something other than what it is. Deception was more common in the past than it is currently (Kalof, Dan and Dietz 2008). Deception may be more widespread in experimental research (Bryman 2016). It is expected that researchers will be honest about their research aims and procedures (Kalof, Dan and Dietz 2008). Deception was a non-issue for this study, as participants were informed about the study, its purpose, and the procedures.

3.15.5 Stage specific ethical issues

The principles of research ethics overlap and lead to general ethical issues such as avoidance of harm, privacy, voluntary participation, confidentiality and anonymity and responsibility in analysing and reporting. Saunders, Lewis, and Thornhill (2016), discuss stage specific ethical issues in detail. At the stage of formulating the research topic, ethical considerations would look into any possible harm and recognition of responsibilities towards participants. Ethical considerations for this study started at the very outset of the study. Ethical issues were considered and evaluated initially during the research proposal candidacy. When designing research and gaining access to appropriate data sources, it is important to consider ethical issues such as participants' right to be fully informed, right to give informed consent, right to privacy and right to absence of coercion.

The stages of designing the research and gaining access to data sources and that of data collection have some common ethical issues that include right to absence of coercion by the researcher, participants' rights to be fully informed and ask questions, participants' rights to give informed consent, participants' rights to confidentiality and anonymity, avoidance of harm, participants' rights to withdraw from the study and participants' rights to privacy. In the last two stages of the research which involve (1) processing and storing data and (2) data analysis and reporting findings, ethical issues such as confidentiality and anonymity should be maintained, as should the agreement regarding consent.

Figure 3.14 summarises the different ethical considerations at the various stages of the research as discussed above, based on the work of (Saunders, Lewis and Thornhill 2016; Bryman 2016).

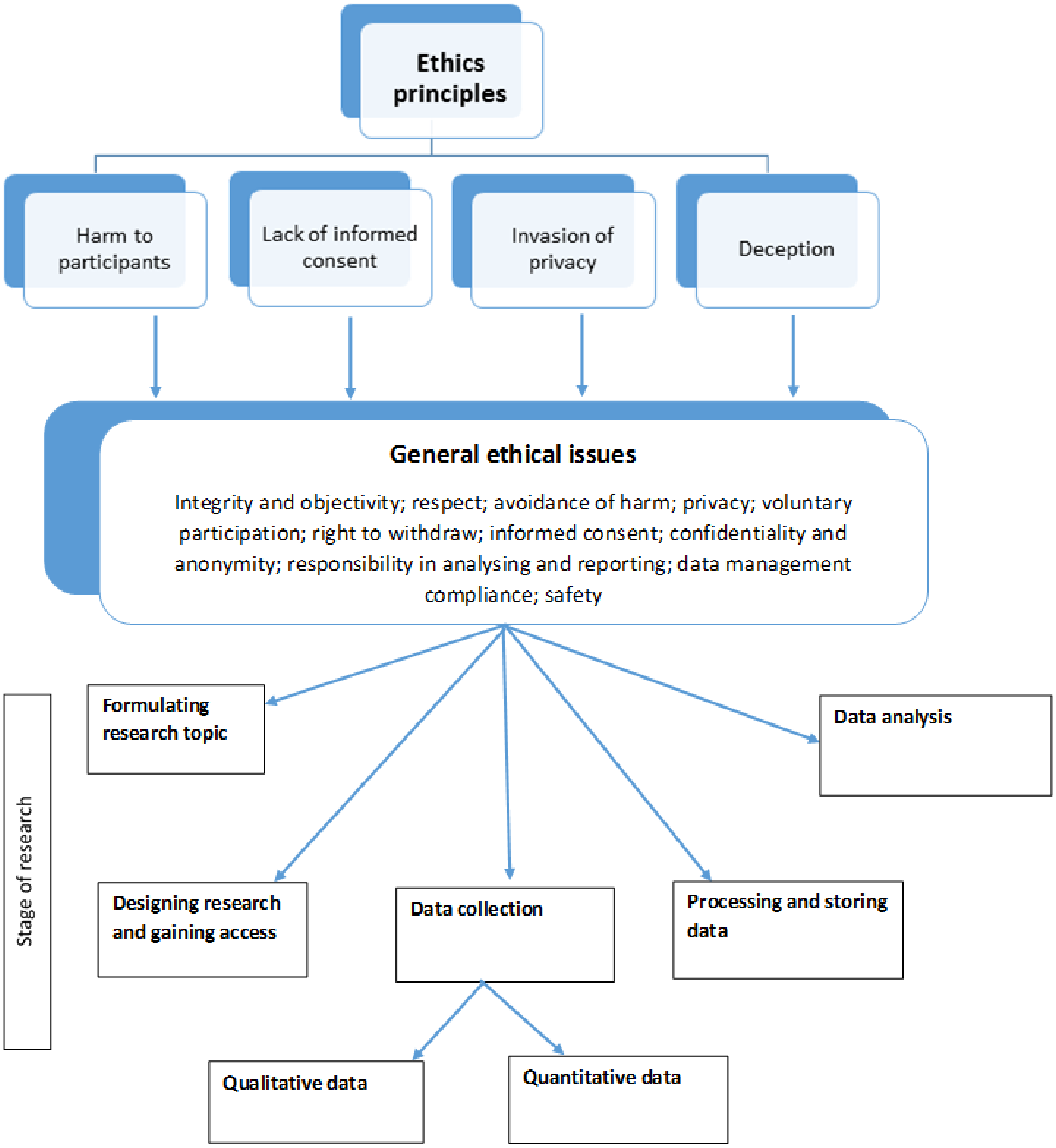


Figure 3.14. Summary of ethical considerations adopted from (Saunders, Lewis and Thornhill 2016; Bryman 2016) (prepared by researcher)

3.16 Conclusion

This chapter discusses the research questions and explains the theoretical and practical significance of this research. It also describes the research methodology adopted for this study and positions the study within a research paradigm that captures the different dimensions of the research questions. The chapter discusses the research philosophy considering the different epistemologies and justifies why pragmatism was selected for this research. The chapter explains the research process with justifications throughout the process. The chapter justified the research method used in this study which is a mixed methods approach. The research instruments used in the mixed-methods approach are discussed which are interviews, focus group discussions and a survey. Guidelines for the each of the data collection phases are provided. The chapter also looks at the advantages and limitations of each of the data collection methods. Sampling of participants for each of the phases is provided. The methods of data analyses employed are presented in this chapter. The chapter concludes by discussing how the physical and electronic collected data are store. The chapter concludes by discussing the ethical considerations for this study. In Chapter 4, the analysis of the first phase of qualitative data from the interviews will be conducted. This lays the foundation for the consideration of several factors related to m-learning implementation in Zimbabwe, which are further developed through focus group discussions and a survey.

Chapter 4

4. Interviews data analysis

4.1 Introduction

Chapter 3 explored the research questions and significance of this research and comprehensively examined the research methodology applied in this study. The purpose of this study is to investigate the feasibility of implementing m-learning in tertiary institutions with a focus on both academic and administrative support in emerging economies such as Zimbabwe. This chapter follows the research methodology chapter which described the research design employed to achieve the aims and objectives of this study, as well as the techniques and procedures used to collect data. Qualitative data was collected from a sample of key stakeholders in m-learning in Zimbabwe tertiary institutions to answer the research questions. The qualitative approach consisted of two phases.

The first phase involved email interviews with some of the key m-learning stakeholders comprising library staff, faculty heads, lecturers and IT support staff. This chapter discusses the analyses of the email interview data. The chapter also presents new findings arising from data provided by each of the different stakeholders, gives an overview of the findings, and concludes by modifying the initial proposed model to incorporate the new findings.

4.2 Thematic analysis

The thematic analysis process was used to analyse the email interview data obtained from the different stakeholders. The analysis followed the six steps suggested by (Braun and Clarke 2006) shown in Table 4.1. The thematic analysis by (Braun and Clarke 2006) is arguably one of the most influential approaches to thematic analysis because it offers a clear and usable framework for conducting thematic analysis. This approach was chosen for its excellent structure.

Table 4. 1 Steps for thematic analysis (Braun and Clarke 2006) (prepared by researcher)

Step	What is involved in the step
1. Become familiar with the data	Transcribing data, reading and re-reading data, noting down initial ideas.
2. Generate initial codes	This involves generating concise labels for important features of the data of relevance to the research question(s) guiding the analysis.
3. Search for themes	A theme is a coherent and meaningful pattern in the data relevant to the research question(s). Searching for themes involves looking into the codes to identify similarities and differences and coming up with new codes in some cases. Themes are constructed based on different codes. All the coded data relevant to each theme are collated.
4. Review themes	Checking if themes work in relation to the coded extracts and the entire data set.
5. Define themes	Defining and naming themes involved a detailed analysis of each theme. This involved: ➢ Exploring what story each theme told. ➢ Examining how the theme fits into the overall story about the data ➢ Identifying the "essence" of each theme and coming up with a concise and informative name of the theme.
6. Producing report	Final opportunity of analysis. Selection of compelling extract examples and relating back to research question(s) and literature.

4.3 Library staff

A random sample was selected from the library staff in different universities. Figure 4.1 describes the sample.

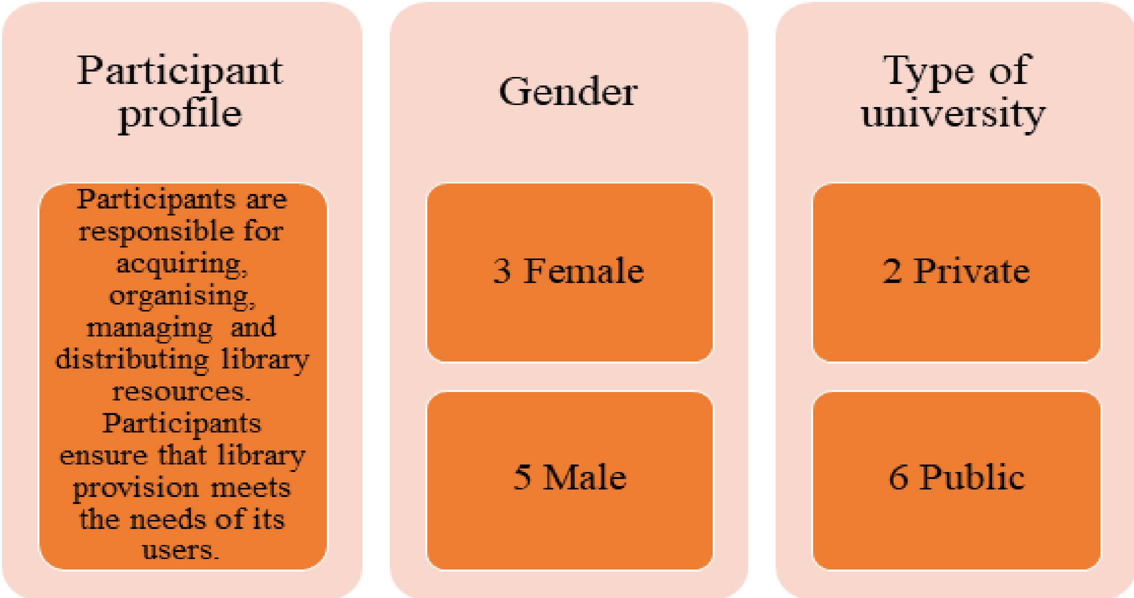


Figure 4.1. Sampling of library staff

4.3.1 Familiarisation with the data

To familiarise the researcher with the data from the library staff, the qualitative responses received via email were read and re-read a number of times and notes were taken. The notes were taken to obtain a first impression of the library staff perceptions of m-learning, in order to capture the essential information before analysing the data. Notes were limited to a maximum of 50 words to capture early impressions of each of the respondents. Notes were taken for each of the respondents to obtain an idea of the data for each individual. Appendix F presents the respondents and first-impression notes. The respondents were identified using a code instead of their actual names.

The data collection involved sending emails to the potential participants who are the library staff in Zimbabwe university libraries. The emails were sent between February and March of 2018. A total of 26 emails were sent to 26 different library staff. There was some follow–up emails after two weeks when there was no response. Each response was initially read on receipt. Eventually, all the responses gathered were exported to NVivo 12 Pro software as Word documents.

Some participants provided more details than others in their written responses. There were eight pages of interview data comprising 1,982 words. The reading and familiarising with the data took the researcher about eighteen hours for the eight participants. Interpreting the data using NVivo 12 Pro software took about ten hours.

4.3.2. Generation of initial codes

A hybrid approach was adopted for the generation of codes, involving both deduction and induction. The deductive approach outlined by Boyatzis (1998) related to the research questions and interview questions, using predetermined codes based on key concepts in the theoretical construct. The generation of initial codes for library staff, faculty heads, lecturers and IT support staff was based on the literature review as well as the data collected. The theory-driven themes enable the researcher to extend, replicate and refute previous studies. Figure 4.2, gives the initial codes derived from the theory-driven codes using NVivo 12 Pro.

Nodes

Name	Sources	References
Interview Questions	0	0
Anticipated benefits of m-learning	6	6
Benefits and challenges of using mobile	8	8
Content suitable for mobile devices	8	8
Digital services	8	8
Information resources	8	8
m-learning affordances	8	8
mobile device impact on resources	8	8

Figure 4. 2 Library staff overall initial coding

An example of the initial generation of codes from some statements from the library staff is shown in Table 4. 2

Table 4. 2 Generation of initial codes-library staff

Statement	Code(s)
Most of the resources are available when needed by students and lecturers. However, in some cases due to unreliable internet connections and low bandwidth, access to some other online databases is limited.	Increased access Infrastructure problems
The use of mobile devices will greatly improve the access to Library services, as students will have unlimited access to the resources via the internet. Mobile gadgets are convenient as students would be able to access Library resources even outside the Library	Benefits of m-learning
Yes researchers can use their smart phones to search for whatever content they like, just like the same way they use computers	Accessibility of resources
Yes it will and it has affect the library in a positive way because students can now be able to have access to resources from wherever they are through off-campus and on-campus facility	Increased access to learning material
Mobile devices are not limited by time nor distance, they allow for simultaneous access, they give access to information at a global level and students get very current and authoritative sources since online publishing if faster than print publishing.	Increased access to learning material
Some can afford powerful devices which can perform just like a laptop or desktop while others may resort to less powerful mobile devices.	Digital divide
It will definitely have a great impact of students learning in the sense that information resources would be readily available	Increased access
Lack of concentration due to social media platforms e.g. Facebook, Twitter etc.	Distraction to academic work

The theory-based deductive approach was used to generate various codes. The codes that emerged and their meanings are presented in Table 4.3.

Table 4. 3 Theory-driven codes and meanings for library staff data (by researcher)

Theory-driven code	Meaning of code
Anticipated benefits of m-learning	The potentials of m-learning
Benefits and challenges of using mobile devices	The pros and cons of using mobile devices
Content suitability for mobile devices	How the content offered by the library is suited for use on mobile devices
Digital services	What digital services are available for students from the library
Information resources	The general resources the library offers
m-learning affordances	What are the m-learning affordances identified?
Mobile device impact on resources	How will mobile devices impact the available resources?

After the initial coding based on the research questions and interview questions, coding was data-driven. The data was read carefully to find useful text relevant to the research topic. The units of text addressing the same issue were grouped together under categories and sub-categories (using nodes and sub-nodes in NVivo 12 Pro). Table 4.4 contains the data-driven codes and the meanings. The aim of the data-driven coding was to discover patterns of meaning based on the naturally-occurring themes in the data. By following a deductive-inductive approach, the researcher follows the predetermined categories but is also open to new concepts/themes emerging from the data.

Table 4. 4 Data-driven codes and meanings for library staff data (by researcher)

Name of data-driven code	Meaning of code
Digital resources	Capacity to use online library resources. This code considers what online resources are available and how learners access these resources. Sub-nodes: Type of resources, Availability, Accessibility, compatibility with mobile devices.
Challenges of using mobile devices	Problems that may arise from using mobile devices. Sub-nodes: Social problems, problems inherent with mobile devices, the kind of learning, affordability.
Benefits of using mobile devices	The advantages of using mobile devices, Sub-nodes: convenience, type of learning, increased access, portability.

4.3.3. Searching for themes

All the coded data relevant to each theme were collated. The first set of themes is depicted in Figure 4.3

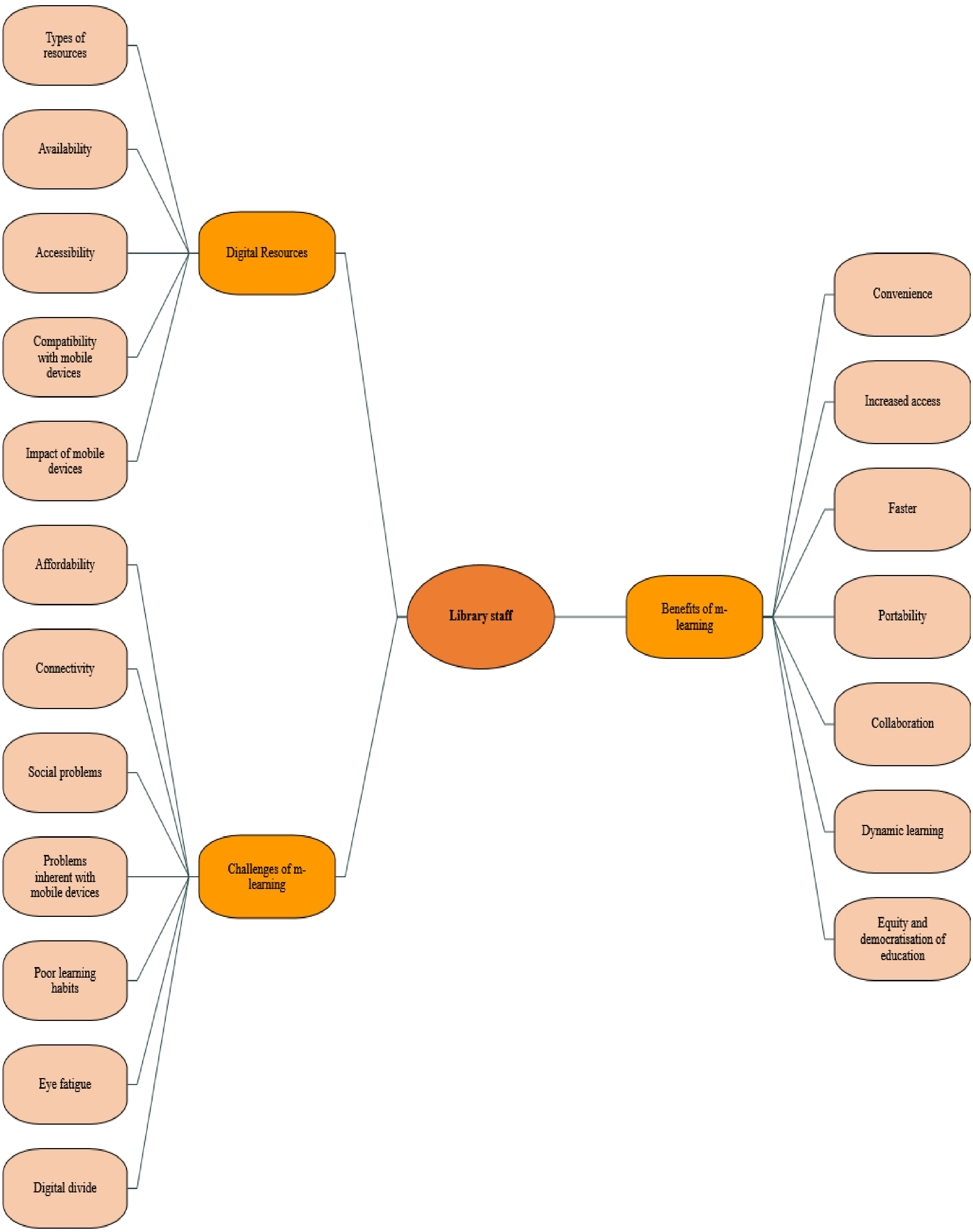


Figure 4. 3 First set of themes (prepared by researcher)

The first three themes that emerged from the data are digital resources, challenges of m-learning and benefits of m-learning. Figure 4.4 depicts the initial themes and the corresponding sub-themes. Upon further examination of the themes and sub-themes, the researcher noted that some of the sub-themes worked together to produce one sub-theme. The theme related to m-learning challenges revealed problems associated with using mobile devices as well as problems that could hinder m-learning adoption. The researcher decided to re-examine the other themes to find other codes related to factors that could be under the theme factors influencing m-learning adoption.

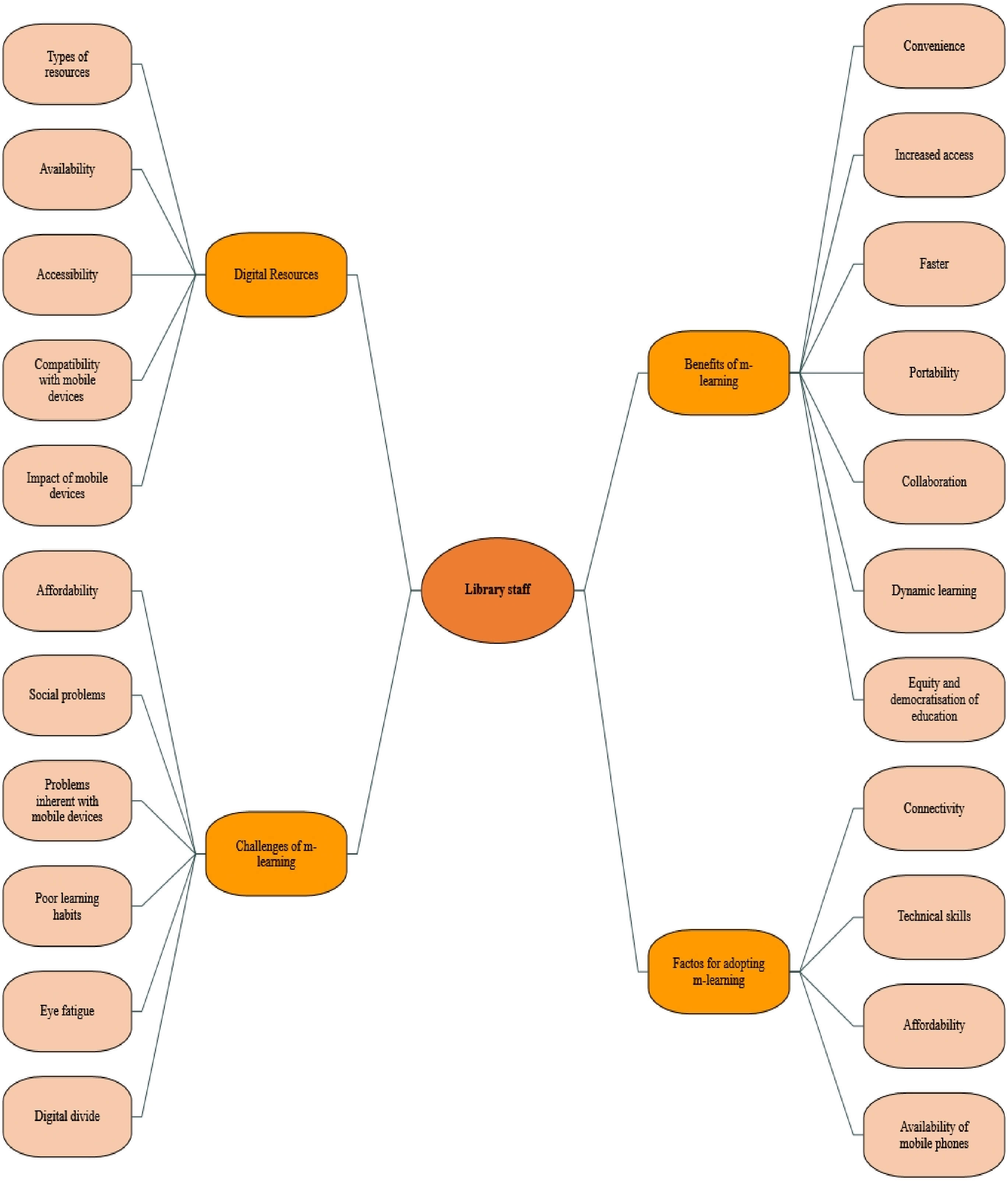


Figure 4. 4 Revision of themes (prepared by researcher)

4.3.4 Revision of themes

In addition to the first three themes - identified digital resources, challenges of m-learning and benefits of m-learning - another theme factor associated with the adoption of m-learning was added.

Mind maps were used to indicate relationships within themes. The themes were continuously refined in relation to the coded data. This ensured that the data within themes was coherent in meaning. The final result of the revision of the themes is depicted in Figure 4.5. Some sub-themes were grouped together as they were related; e.g. convenience hinges on the portability of mobile devices.

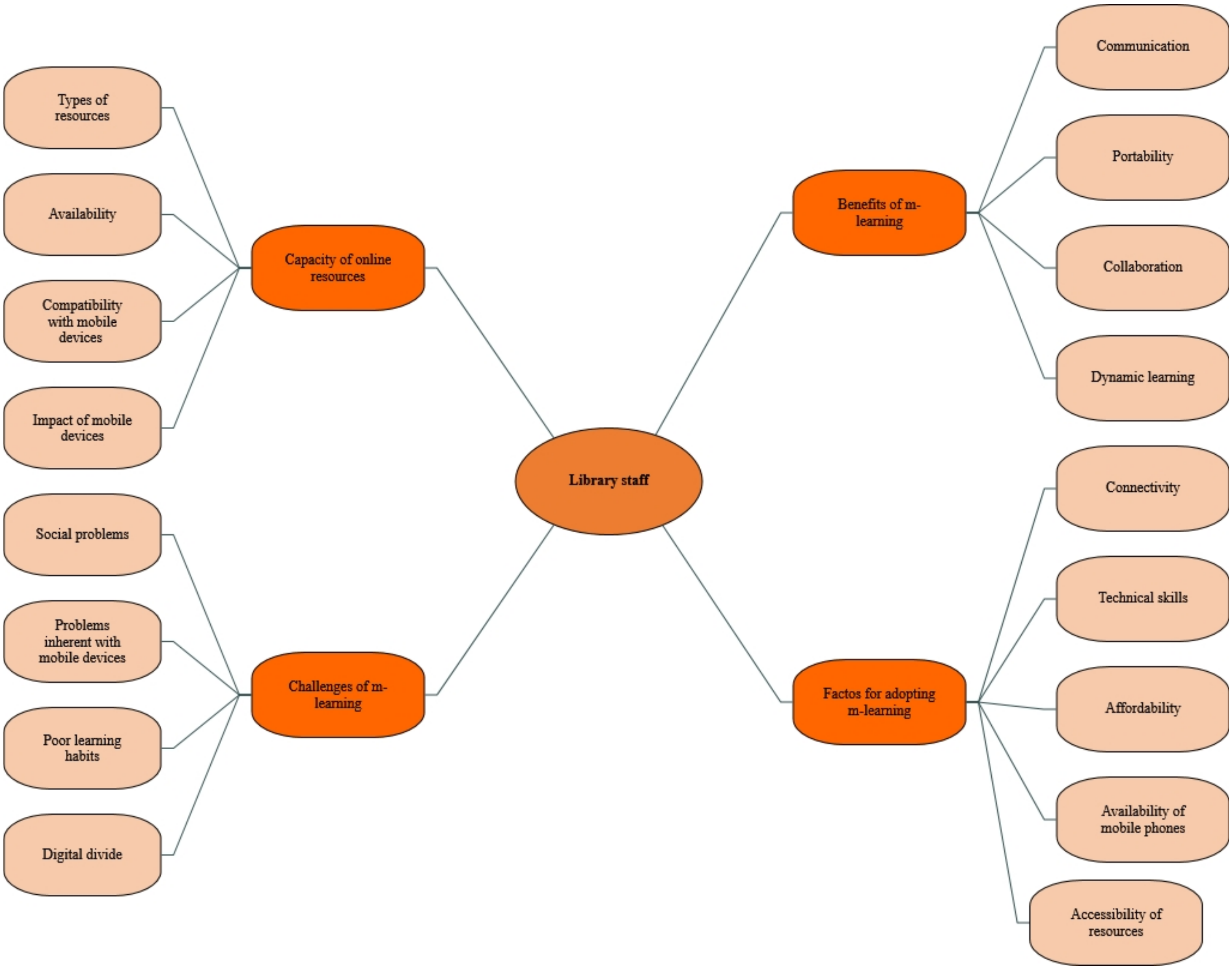


Figure 4. 5 Final revision of themes (prepared by researcher)

For consistency with the initial model, the colours set in the initial model will be used in the themes. If a theme is not consistent with what is in the initial model a grey colour will be used as shown in Figure 4.6 :

M-learning characteristics	
m-learning challenges	
Factors influencing m-learning adoption	
Pedagogy	
New themes emerging from data	

Figure 4. 6 Colours used for the themes

The themes that emerged were based on the literature and the data collected from the library staff. Four themes emerged from the narratives of the library staff (Figure 4. 7):

- ➢ Capacity of online resources

- Factors for adopting m-learning
- M-learning benefits
- Challenges of m-learning

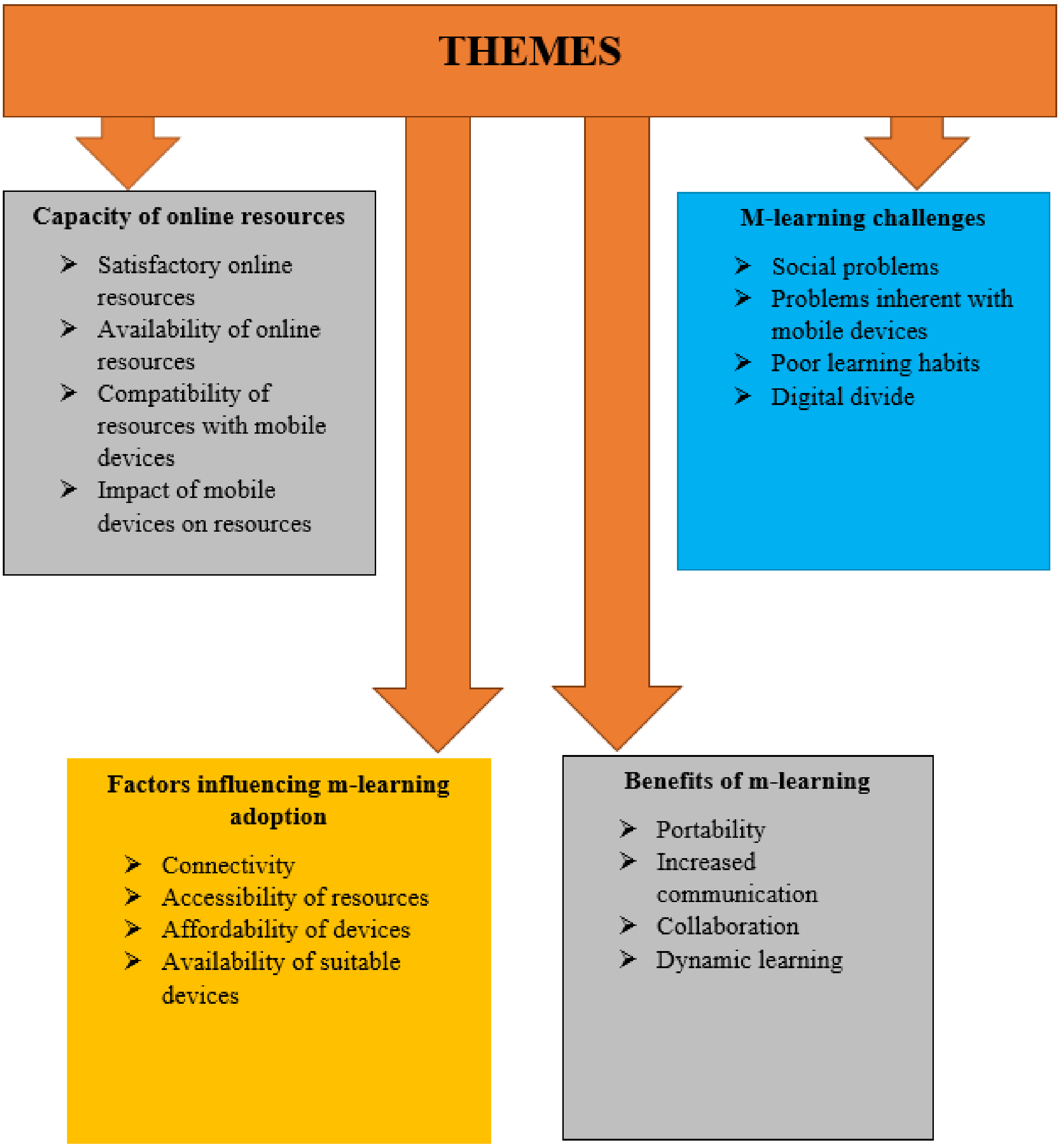


Figure 4. 7 Themes and sub-themes emerging from library staff data (by researcher)

4.3.5 Theme 1: Capacity of online resources

Although some m-learning resources can be used in non-networked and offline environments, many depend heavily on Internet access (Caudill 2007). Online resources are helpful to students if they have access to the Internet. The availability of resources and cost to access these resources are crucial factors in m-learning design (Dickerson and Browning 2009). The libraries in Zimbabwe are equipped with three types of resources: (1) those in print format such as hardcopy texts and hardcopy journal articles; (2) multimedia resources such as DVDs, CDs and audio tapes; and (3) Electronic resources or online resources such as EBooks, electronic serials and online databases. While print and multimedia resources remain essential in libraries, when considering m-learning, it is the online resources that are of importance as mobile learners utilise these library resources using mobile technologies. To this end, it is important to establish the capacity of the online resources. The capacity of online resources will be explored through the lenses of:

- Types of electronic or online resources the libraries.
- Availability of resources.
- Compatibility of resources with mobile devices.
- Impact of mobile devices on the online resources.

The library is the gateway to locating information (Housewright and Schonfeld 2008). If learners are unable to use online resources via their mobile technologies, this may hamper m-learning adoption. On the other hand, library staff understand faculty needs and assist in the information strategy of tertiary institutions. If the library staff feel that the capacity of online resources is inadequate for academic benefit using mobile technologies, they may not buy into m-learning as there will be no benefit in this technology if the online resources are inadequate.

4.3.5.1 Satisfactory online resources

Most library staff report that their libraries have electronic academic resources such as serials (periodicals), databases, eBooks, past exam papers, theses, and books on kindles. Apart from academic resources, one librarian indicated that their library provides awareness services using social media (Twitter, Facebook, the library blog and WhatsApp). The library staff are satisfied with the number of digital resources in libraries. Librarians describe online library resources as relevant. The interviews demonstrate that online resources in the different Zimbabwe libraries range from satisfactory to comprehensive. It is apparent from Table 4.5 that Zimbabwe university libraries, while not equally resourced, nevertheless have adequate resources.

Table 4. 5 Librarians' comments on types and distribution of online resources

Respondents	**Comments**
Library_Staff_1	*"Most of the resources are available when needed by students and lecturers."*
Library_Staff_3	*"There is fair distribution of information resources among students and lecturers."*
Library_Staff_7	o *"We have subscribed Journal databases like EBSCO, EMERALD, Oxford Journals, Biomedical and Life Sciences Collection etc. We also have the ones availed to developing countries AGORA, HINARI etc."* o *"University Library has comprehensive information resources both in print and in digital format."*

4.3.5.2 Availability of resources

Librarians mentioned that online resources are readily available because these resources are online. Some librarians stated that the online resources are readily accessible on and off campus. Participants feel that because the resources are online, they are accessible 24/7 throughout the year. The interviews revealed that while some librarians are content that the online resources are in principle available for use, a minority of these librarians believed that there were some difficulties with accessing the available resources.

> [Library_Staff_1] states that, *"unreliable Internet connections and low bandwidth which makes it difficult to access the online databases."*

Another issue raised was that some of the online resources could not be accessed using mobile devices.

> [Library_Staff_1]: *"The Open Public Access Catalogue (OPAC) and most of the databases subscribed to by the library are not accessible on mobile devices."*

The researcher agrees that although the availability of online resources is in principle available 24/7, the resources may not be accessible to the learners for the same period. If students cannot access the resources because of low bandwidth or poor Internet connection, then they cannot utilize them. Given the poor Internet connections, access can be described as questionable or non-existent. M-learning facilitates easily-accessible learning, if the online resources are not accessible using mobile devices, this takes away students' ability to study anywhere anytime as they would have to go to the library to access resources, thus removing the advantages of flexibility and mobility.

4.3.5.3 Compatibility of online resources with mobile devices

With the exception of one participant, all others agreed that the online resources can be accessed via mobile devices. In the one case, the participant acknowledges that the library website is accessible using mobile devices; however, the essential online databases the library subscribes to are not accessible via mobile devices. Most participants believed that the online resources are accessible via the Internet and are therefore accessible using mobile devices. The interviews revealed that:

1. Online resources accessible on mobile devices are not uniform. The resources vary from library catalogues, communication messages concerning resources and academic resources. Table 4. 6 highlights some differences in resourcing of libraries in Zimbabwe universities.

Table 4. 6 Librarians' comments showing indicating non-uniformity of online resources

Respondents	**Comments**
Library_Staff_4	*"Yes, it does through the provision of electronic resources for content and e-services such e-tutorial, online chat among others."*
Library_Staff_6	*"All communication of new services and resources in the library is through Facebook, WhatsApp and SMS on mobile devices. Occasionally, Word processed documents can be attached to WhatsApp platforms on mobile devices."*

2. Not all available online resources are accessible using mobile devices. Table 4.7 shows that different institutions have particular and varying amounts of resources that are accessible on mobile devices.

Table 4. 7 Librarians' comments showing that not all online resources are accessible via mobile devices

Respondents	Comments
Library_Staff_1	*"The library's website link is accessible on mobile devices."*
Library_Staff_5	*"[Firstly], the library catalogue is hosted on the World Wide Web so can be accessible on any mobile device."*
Library_Staff_7	*"The Online Public Access catalogue is accessible using mobile phones."*
Library_Staff_8	*"Availability of e-books and book chapters on kindles, online orientation videos, e-books and e-journals and access to multimedia information resources"*

3. There is evidence that specific mobile devices are required to access the online resources.

   [Library_Staff_3]: *"Yes researchers can use their smart phones to search for whatever content they like, just like the same way they use computers."*

4.3.5.4 Impact of mobile devices on resources

Some advantages of m-learning depend on accessibility. Advantages of access with m-learning depend on time, convenience and place (Caudill 2007). Accessing learning through different choices gives students the freedom to learn in the most comfortable environment for their purposes (Crescente and Lee 2011). In all cases, informants suggest that mobile devices would have a positive impact on the library services. It is suggested that the use of mobile technologies would increase students' access to online resources. Library staff believe that with mobile devices, learners could have unlimited access to library resources from different locations via the Internet. Library staff added that students could use mobile devices to access resources at any given time. Another positive impact of using mobile devices is that students will not be limited to using print resources only. It is also suggested that students will no longer be limited by the physical closing down of the library at the end of each day.

The impact of mobile technologies on online resources centre on increased access to these resources, making the learning experience more comfortable to the student as they choose their environment of learning. In addition, access of online resources using mobile devices translates to convenience for the students as they are not limited by time or location in accessing resources.

4.3.6 Theme 2: Factors for adopting m-learning

Factors that influence m-learning adoption are varied. It is important to consider factors that influence m-learning adoption from the library staff perspective, given that these are the people well versed with the faculty information needs. By considering factors of m-learning from a librarian perspective, this may assist in examining the needs of students, academics, and librarians. A consideration of these needs may give rise to a more accurate vision of what is required for m-learning to be successful. The library staff's responses show that the factors that influence m-learning adoption in Zimbabwe are connectivity, accessibility of resources, technical skills, affordability of mobile devices, and the availability of suitable mobile devices.

4.3.6.1 Connectivity

Internet connectivity (connectivity) can be a barrier to m-learning as discussed in section 2.9.1.2. Library staff expressed concern about poor Internet connectivity. The interviewees indicated that Internet connections are unreliable, poor to the point of being frustrating, slow and characterised by disconnections. Table 4.8 presents librarians' comments regarding Internet connectivity.

Table 4. 8 Librarians' comments on poor connectivity

Respondents	**Comments**
Library_Staff_8	*"Inadequate equipment to facilitate access to e-resources"*
Library_Staff_1	*"Unreliable Internet coupled with low bandwidth make it difficult to access the online databases."*
Library_Staff_6	*"Poor network connections can be very frustrating."*
Library_Staff_7	*"Response may be slow."*

4.3.6.2 Accessibility of resources

The accessibility of resources depends heavily on Internet connectivity. Librarians indicated that they have online resources for learners which can be accessed on or off campus. Accessibility on campus seems guaranteed, with some informants suggesting this access is via the Local Area Network (LAN). Access off-campus depends on the Internet connection on the mobile device. The limited infrastructure to facilitate online resources affects connectivity. With little infrastructure, this translates to poor connectivity which negatively affects the accessibility of online resources.

> [Library_Staff_1]: *"However, in some cases due to unreliable internet connections and low bandwidth, access to some other online databases is limited."*

> [Library _Staff_2]: *"The use of mobile devices will greatly improve the access to Library services, as students will have unlimited access to the resources via the Internet."*

4.3.6.3 Technical skills

It is suggested that there is a lack of technical skills when using mobile devices for m-learning.

> [Library_Staff_1]: *"There is a lack of technical skills".*

The lack of technical skills can affect both learners and library staff and could possibly extend to other m-learning stakeholders in tertiary institutions.

4.3.6.4 Affordability

The affordability of mobile devices remains relative, although mobile penetration rates demonstrate significant growth. Half of the informants feel that the cost of mobile devices is out of reach for most students. In addition, the library staff took into consideration the cost of Internet access for the students, further exacerbating the affordability issue. Table 4.9 shows comments on affordability and indicate that some library staff feel mobile devices are not affordable for all learners. It is evident that, although in some parts of the world mobile devices are regarded as inexpensive, the same is not true for Zimbabwe. This finding contradicts previous studies which suggest that a decrease in cost of mobile devices has made them more accessible to most people, making the devices attractive for the dissemination of knowledge (Iqbal and Qureshi 2012; Miangah and Nezarat 2012). The cost of mobile devices and the cost of Internet services which underpin affordability are important in the adoption of m-learning.

Table 4. 9 Librarians' comments on affordability

Respondents	Comments
Libray_Staff__1	*"The cost of learning increases thereby only the 'elite' can afford gadgets as well as Internet access costs"*
Library_Staff_2	*"Mobile devices do not always come cheap, hence some people may not afford to purchase them."*
Library_Staff_5	*"Mobile devices are expensive to purchase."*
Library_Staff_6	*"Not all students will afford powerful mobile devices."*

4.3.6.5 Availability of suitable mobile devices

Suitable devices are required to make m-learning effective. A small number of the respondents discussed the need of suitable mobile devices to access online resources. The library staff who discussed the availability of suitable mobile devices for accessing online library resources indicate that the mobile devices should have particular computing power or functionalities to be of use, and that some available mobile devices are not compatible with the available online resources. The difference in computing power or functionalities on the devices may translate to some students having more advantages than others. This finding corroborates earlier studies that suggest that suitable devices are those that meet the minimal technical specifications for m-learning to be effective (Dickerson and Browning 2009; Ozdamli 2012). The comments presented in Table 4. 10 suggest that library staff are well aware that students have mobile devices with varying capabilities and functionalities which can affect m-learning adoption and implementation.

Table 4. 10 Librarians' comments on availability of suitable mobile devices

Respondents	Comments
Library_Staff_1	*"[lack of] compatibility of mobile devices"*
Library_Staff_3	*"Researchers can use their smartphones to search for whatever content they like"*
Library_Staff_6	*"Functionalities on the devices may not give the students the same advantages"*

4.3.7 Theme 3: Benefits of m-learning

This theme relates to the envisaged benefits of m-learning in a Zimbabwean context. When benefits can be realized, it is easier to get buy-in from the different stakeholders of m-learning. With the library being pivotal to the information resources in tertiary institutions, if the benefits of m-learning can be realized by these key stakeholders, it is likely that librarians would promote m-learning as a way of addressing information needs coupled with the numerous other affordances of m-learning.

4.3.7.1 Portability and convenience

The key benefits of m-learning according to the informants hinge on the portability of mobile devices. Some respondents believe mobile devices are convenient. Others felt that mobile devices can save learners the time and effort of having to go to the library, as they can access resources from anywhere. Other respondents mentioned that mobile devices can be carried anywhere at any given time. Another informant mentioned that with m-learning they are no geographic boundaries. Another informant suggested that m-learning leads to increased and improved access to learning resources.

4.3.7.2 Increased communication

Other respondents mentioned that one benefit of m-learning is that it offers more efficient communication in the form of:

- Quicker communication of academic instruction.
- Faster way of broadcasting information on SMS or social media.
- Quicker clarification of academic material when required.
- Instant answers.
- Quicker acknowledgement of academic instruction by learners.
- Faster communication between learners and instructors and between learners.

4.3.7.3 Increased access

Other respondents stated that m-learning increases access. There are expectations that m-learning will lead to higher pass rates. There are also suggestions that m-learning enables learners to have more access to learning resources, with others mentioning wider access to resources including social learning.

> [Library_Staff_5]: *"Mobile devices allow for simultaneous access; they give access to information at a global level and students get very current and authoritative sources since online publishing if faster than print publishing."*

4.3.7.4 Collaboration

M-learning offers collaboration opportunities for learners (section 2.8.1.5). Some librarians believe that m-learning leads to information sharing. One librarian commented that students are able to exchange and share knowledge on a larger scale than before. Another respondent stated that m-learning will improve and speed up the exchange of information between students and their lecturers.

4.3.7.5 Dynamic learning

M-learning enables students to experience dynamic learning. Some librarians allude to the notion that m-learning will positively change the way of learning. Librarians suggest that m-learning will increase the learning ability without physically going to the lecture rooms. Another librarian suggests that m-learning will make learning more fun and enjoyable. One informant suggested that m-learning will increase digital literacy. Another respondent describes m-learning as a means of democratising access to education across the country and increasing equity and quality of education. Table 4.11 discusses the benefits of m-learning according to library staff in Zimbabwe universities. Consistent with the literature, the benefits of m-learning expressed by the library staff in general support previous studies linking the portability of mobile devices with increased access, increased communication, collaboration and convenience (Ally and Tsinakos 2014; Asiimwe and Grönlund 2015; Barker, Krull and Mallinson 2005; El-Hussein 2010; Hsu and Ching 2015; Melhuish and Falloon 2010). While it may not be surprising that librarians mention increased access to resources, it is interesting that library staff are keen to see students collaborate and have a more enjoyable learning experience.

Table 4. 11 Librarians' comments on benefits of m-learning

Respondents	**Comments**
Library_Staff_1	○ *"Increased and improved access to resources."* ○ *"Saves time to go to library"* ○ *"Learning becomes more fun and enjoyable"* ○ *"Faster and easier communication between instructors and peers"*
Library_Staff_2	○ *"Mobile devices enable information to be conveyed over wider area and remote locations of the country."* ○ *"They [mobile devices] are also faster compared to other devices such as computers."* ○ *"Mobile devices are handy and convenient as you can carry them anywhere at any given time."* ○ *"Students will be able to exchange knowledge on a larger scale than before."*
Library_Staff_3	○ *"Instead of going physically to lecture rooms they [learners] can get the information they need using their mobile phones."* ○ *"It will actually increase their[students] learning ability"* ○ *"Instant answers."*
Library_Staff_4	○ *"Students will be able to send their work to their lecturers using their mobile devices."*
Library_Staff_5	○ *"[m-learning] offers access to vast sources of information not limited by time nor distance."* ○ *"They [mobile devices] are convenient."* ○ *"They [students] are able to share information."*
Library_Staff_6	○ *"Quick messaging of academic instruction and tasking broadcasting on group SMS or WhatsApp group or Facebook.* ○ *"Quick clarification of instruction whenever required"* ○ *"Quick acknowledgement of receipt by students."*
Library_Staff_7	○ *"Information resources will be readily available."* ○ *"No geographic boundaries."*

4.3.8 Theme 4: Challenges of m-learning

M-learning challenges are comprehensively discussed in section 2.9. Library staff highlight some challenges to m-learning from the Zimbabwean perspective. These challenges are classified into four categories.

4.3.8.1 Social problems

The interviews revealed that some problems of adopting m-learning are related to social issues. Half of the informants' report that m-learning can distract students from their academic work. One librarian suggested that other social problems associated with m-learning were cyber bullying and students accessing inappropriate material. The findings corroborate those of previous studies that suggested that mobile devices can be a distraction for students (Crescente and Lee 2011; Gong and Wallace 2012). Table 4.12 shows some of the social problems associated with m-learning according to library staff.

Table 4. 12 Librarians' comments on social problems

Respondents	**Comments**
Library_Staff_3	○ *"Distraction from school work".* ○ *"Child predators and cyber bullying."* ○ *"Accessing inappropriate material."*
Library_Staff_4	○ *"Mobile devices are normally not being used to do research or academic work but mainly for social things."*
Library_Staff_6	○ *"Students can easily be carried away by chats, adverts and pay no attention to academic instruction and tasks."*
Library_Staff_8	○ *"Lack of concentration due to social media platforms e.g. Facebook, Twitter etc."*

4.3.8.2 Problems inherent to mobile devices

Some of the barriers to m-learning adoption have to do with the characteristics of the mobile devices themselves as discussed in section 2.11.2. Some aspects of mobile technologies may prevent optimal learning experience. Half of the informants raised concerns about the maintenance of mobile devices. One of the concerns was the need to recharge batteries. This problem was two-fold in that (1) mobile devices need to be recharged and (2) the need for access to electricity. It is evident that not all students have access to electricity. Another informant stated that mobile devices may malfunction, which can be a big drawback. Others commented that mobile devices are prone to theft and can be easily lost. Another interviewee stated that mobile devices are prone to viral attacks if networks are not properly protected. Another suggested that m-learning may lead to eye-fatigue. Table 4.13 presents several problems of m-learning that are related to the inherent nature of mobile devices. The findings that poor electricity supply is a hindrance to technology use in developing countries confirm the conclusions drawn by (Armey and Hosman 2016). The fact that mobile devices are prone to theft may be an indication that they are valuable items in great demand as not everyone can afford them in Zimbabwe.

Table 4. 13 Librarians' comments on problems inherent with to mobile devices

Respondents	Comments
Library_Staff_1	○ *"Eye fatigue."*
Library_Staff_2	○ *"Mobile devices need constant maintenance such as electronic recharging, hence it can be a disadvantage for people without access to electricity."* ○ *"Mobile devices have the disadvantage that they are prone to theft, and can easily be lost."*
Library_Staff_5	○ *"Need electricity for recharge."* ○ *"Prone to theft"*
Library_Staff_6	○ *"Mobile devices are prone to viral attacks through the networks if not well protected."*
Library_Staff_7	○ *"Battery can run out"*

4.3.8.3 Poor learning habits

Several participants made negative comments regarding the learning habits that students could develop when using m-learning. One participant made two comments to this effect:

> [Library_Staff_6]: *"Plagiarism may become rampant, that m-learning will result in a lot of recycling of ideas and information."*

> [Library_Staff_6]: *"M-learning would pave way for poor search skills as one can easily rely on friends for answers or even pay to receive assignment write-ups and that m-learning will hamper independent learning."*

This finding suggests that plagiarism continues to be a challenge and has been reported previously in relation to m-learning (Gong and Wallace 2012; Gómez-Ramirez, Valencia-Arias and Duque 2019). Plagiarism is a concern as it reduces the quality of learning.

4.3.8.4 Digital divide or not

There are divergent views on how m-learning will impact those with mobile devices and those without. Given the cost of mobile devices and the cost of Internet services, some respondents believe that m-learning will not be affordable for all and will therefore create a digital divide.

> [Library_Staff_1]: *"The cost of learning increases thereby only the 'elite' can afford the gadgets as well as Internet access costs."*

There may also be a digital divide even among those with mobile devices, as the devices differ in computational power, which means they will perform differently.

> [Library_Staff_6]: *"Functionalities on the devices may not give students the same advantages. Not all students will afford powerful mobile devices."*

An opposing view suggests that m-learning will democratise access to education across the country.

> [Library_Staff_8]: *"[M-learning] will democratise access to education across the country, reduce costs through equity and quality."*

While m-learning may in the long run reduce learning costs on a big scale, the initial investment costs may be really high and can become a barrier to m-learning implementation. Mobile devices could help to address the digital divide since they are cheaper than desktop computers (Hashemi et al. 2011; Adejo et al. 2018). The findings above, however, seem to contradict this. The wide diversity of mobile devices could create a digital divide as other students will possess devices with more computing power, and the more powerful devices may be out of reach for other students. Although an opposing argument suggests m-learning will create equity in education, this could be true only if institutions provided students with the mobile technologies required. If students have devices with similar appropriate computational power, students would have the same advantages in terms of access to mobile technologies, thus creating equity in education and improving its quality. In considering the challenges of m-learning, there is a need to examine each of the challenges and find means and ways to overcome the challenges. Addressing the barriers to m-learning means the various stakeholders will be more inclined to adopt and implement m-learning.

4.3.9 New findings

The findings from the data collected from library staff were compared to the items in the initial proposed model as shown in Table 4.13. Some mapping is provided to show the similarities between the items in the initial proposed model and the new findings. Similarities in the initial proposed model and the data are depicted by black double-pointed arrows. Where the collected data is at odds with an item in the initial proposed model a red arrow is used, with new findings emerging from the data shown in italics. The common elements from the initial model and the data collected were mainly found under the m-learning characteristics that included collaboration, training, connectivity, ubiquity, and technical support. Under M-learning challenges, the initial model matched the study findings on infrastructure issues.

In Table 4.14, for the initial proposed model, the availability of cheaper mobile phones has influenced m-learning adoption. The data collected from the library staff is contradictory; library staff report that in Zimbabwe mobile phones are expensive and most learners cannot afford them. Some new findings relating to m-learning challenges according to library staff are significant as they reveal the social problems linked to m-learning. These new findings include perceived poor learning habits, how m-learning may increase the digital divide, and problems associated with mobile devices themselves.

The expectations by the library staff hinge on the pros and cons of m-learning. A disadvantage identified by library staff was that m-learning could increase the digital divide among learners because of the cost of mobile devices. Other disadvantages anticipated by the library staff are that m-learning will lead to poor learning habits and cyberbullying, and that learners may end up accessing inappropriate material. Library staff anticipate that with m-learning there will be an improvement in the pass rates and there will be increased access to resources. Based on the opinions of library staff as key m-learning stakeholders in Zimbabwe tertiary institutions, Table 4.14 shows new findings from the interviews in comparison with the initial proposed model.

Table 4. 14 Findings from library staff data

Main aspects in initial proposed model	New Findings in data collected
M-learning challenges	**M-learning challenges**
Infrastructure	Infrastructure
Investment costs	Investment costs
Policies	Policies
	Social problems
	• *distraction form academic work*
	• *Cyber bullying*
Factors influencing m-learning adoption	• *Accessing inappropriate material*
Culture	*Problems Inherent with mobile devices*
Cheaper mobile phones	• *Devices require recharging*
HCI	• *Prone to theft or loss*
	• *Viral attacks*
	• *Malfunction*
	• *Eye-fatigue*
Pedagogy	*Poor learning habits*
Learners’ expectations	• *Plagiarism*
Lecturers’ expectations -training	• *Poor search skills*
Learning theories	• *Dependence on friends to do academic tasks*
	Digital divide-cost of mobile devices may increase digital divide
	Factors influencing m-learning adoption
M-learning characteristics	Culture
Portability	Mobile phones are expensive
Blending	HCI
Collaboration	
Training	
Usability	
Connectivity	**Pedagogy**
Ubiquity	Learners’ expectations
Technical support	Library staff expectations
	Digital divide
	Improved pass rates
	Education equity if all students have access to m-learning
	Increased access to resources
	Increased communication
	Poor learning habits
	Cyberbullying
	Learners accessing inappropriate material
interactivity	Learning theories
context	
mobility	
	M-learning characteristics
	Portability
	Blending
	Collaboration
	Training
	Usability
	Connectivity
	Ubiquity
	Technical support
	Interactivity
	Context
	Mobility

Legend	
double pointed black arrow = similar findings from data and model	⟷
red arrow= findings from data contradict initial model	→
italics = new finding from data collected	***italics***
normal print = aspects in the intial model not discussed in data collected	normal print, no arrows, no italics

4.4 Faculty heads

Random sampling was used to recruit university faculty heads. Sample details are shown in Figure 4.8.

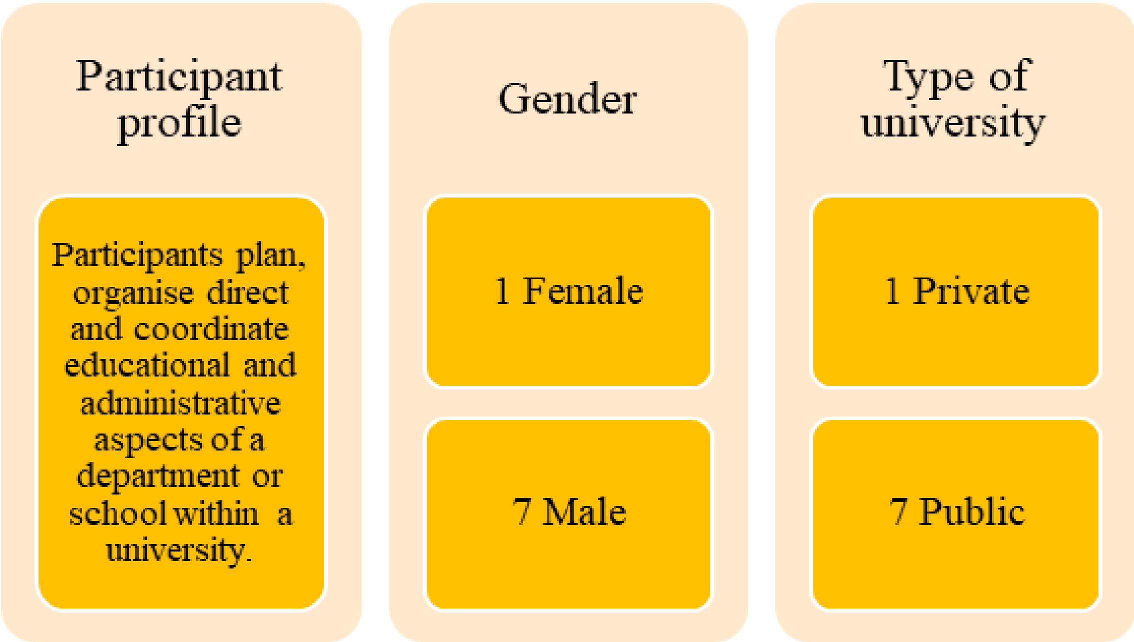


Figure 4. 8 Sample of university faculty heads

The thematic analysis approach was used to analyse the qualitative data obtained from the faculty heads.

4.4.1 Familiarisation with the data

Responses from faculty heads came in different forms. Some faculty heads responded via email, others chose to complete the online survey, while others opted to print the questions and answer them in ink before sending the scanned copies. The qualitative responses received from the faculty heads were read and re-read a number of times and notes were taken. The notes were taken to obtain a first impression of the faculty heads' attitudes towards m-learning, and to capture the essential information before comprehensive analysis commenced. Notes were limited to a maximum of 50 words. Notes were taken for each of the respondents to obtain an idea of the data produced by the faculty heads. Details about the respondents and first-impression notes are presented in Appendix G. The respondents were identified using a code instead of their actual names.

The data collection involved sending emails to the potential participants who are faculty heads in Zimbabwe universities. The emails were sent between February and March of 2018. A total of thirty-two emails were sent to thirty-two different heads of department in the various tertiary institutions. Follow–up emails were sent as reminders to those who had not responded after two weeks. One respondent responded via email, two respondents opted to respond using the online link on Qualtrics and the other five respondents chose to print the questions, write their responses, scan them and then email them to the researcher. Some responses were lengthier than others.

There were eight pages of responses containing interview data comprising 1,223 words.

Reading and familiarisation with the data took the researcher about ten hours in total for the eight participants. Interpreting the data was done manually using highlighter pens, pen and paper, and took about eight hours.

4.4.2 Generation of initial codes

A hybrid approach, comprising inductive and deductive methods, was taken to generate the codes. The deductive approach was applied to the research questions and interview questions which were based on theory contained in the literature. An example of the generation of initial codes based on the statements from the data collected is shown in Table 4. 15.

Table 4. 15 Generation of initial codes-faculty heads

Statement	**Code(s)**
M-learning tools would be more useful to the Zimbabwean students than computers. A larger proportion of our students own mobile devices (smart phones and tablets) than those who own both mobile devices and stationary / laptop computers (if laptop computers are excluded from the m-devices list?). Increased access to and use of m-devices would improve the learning / teaching process in Zimbabwe. We are encouraging the students to use mobile devices in their studies.	Access to mobile devices Benefits of m-learning
It [m-learning] is flexible and can allow students who would have missed lectures to easily catch up	Flexibility
Teaching and learning will be paced at the teacher and learner's convenience when a student is not in the mood he/she can learn when ready.	Flexibility
There is need for lobbying first to get management buy-in.	Management support
Practical work has to be done face-to-face with students as demonstrations have to be carried out	Not suitable for all units
Largely institutions should provide to a greater extent the IT infrastructure and other accessories as you note mobile devices' success in teaching depend largely on the quality of infrastructure.	Infrastructural challenges
The flexibility works very well and gives an advantage as students can learn from anywhere. However, the concept would need to be assimilated well into the current operations considering the amount of change required to an institution that has been running classroom based learning for so many years.	Flexibility Transition from traditional approach

The resulting initial codes drawn from the faculty heads' interviews are given in Figure 4. 9.

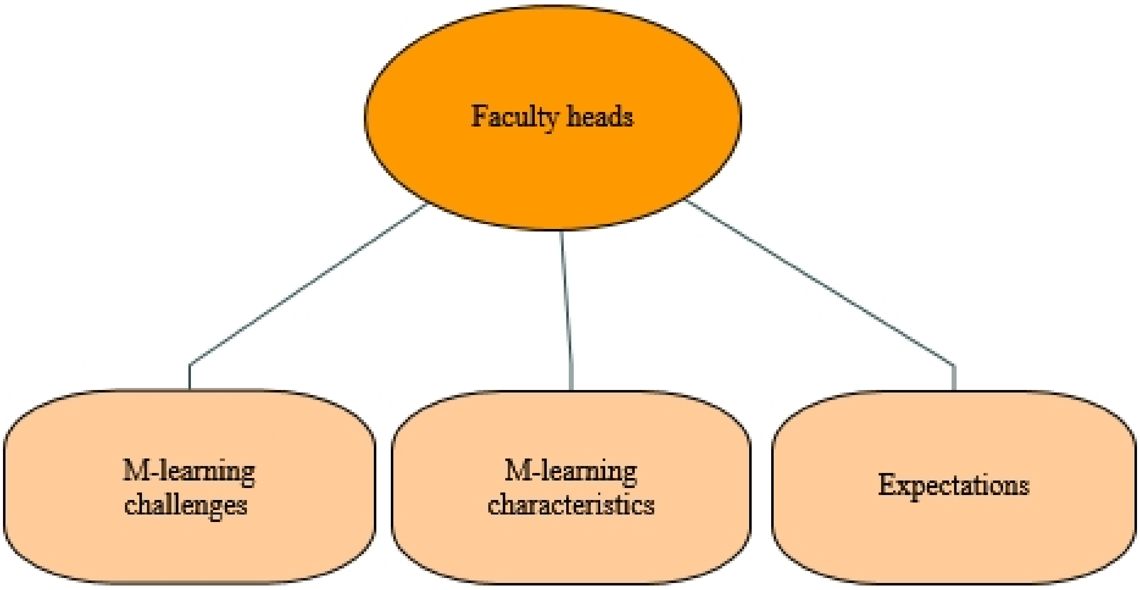


Figure 4. 9 Coding-deductive approach - **Faculty heads** (by researcher)

The deductive approach was followed by the inductive approach, where the coding was data-driven. The inductive approach sought to find codes from the collected data. This resulted in an additional theme emerging, “culture”, together with several sub-nodes for the other previously identified nodes. The resulting themes and their corresponding sub-themes are depicted in Figure 4. 10.

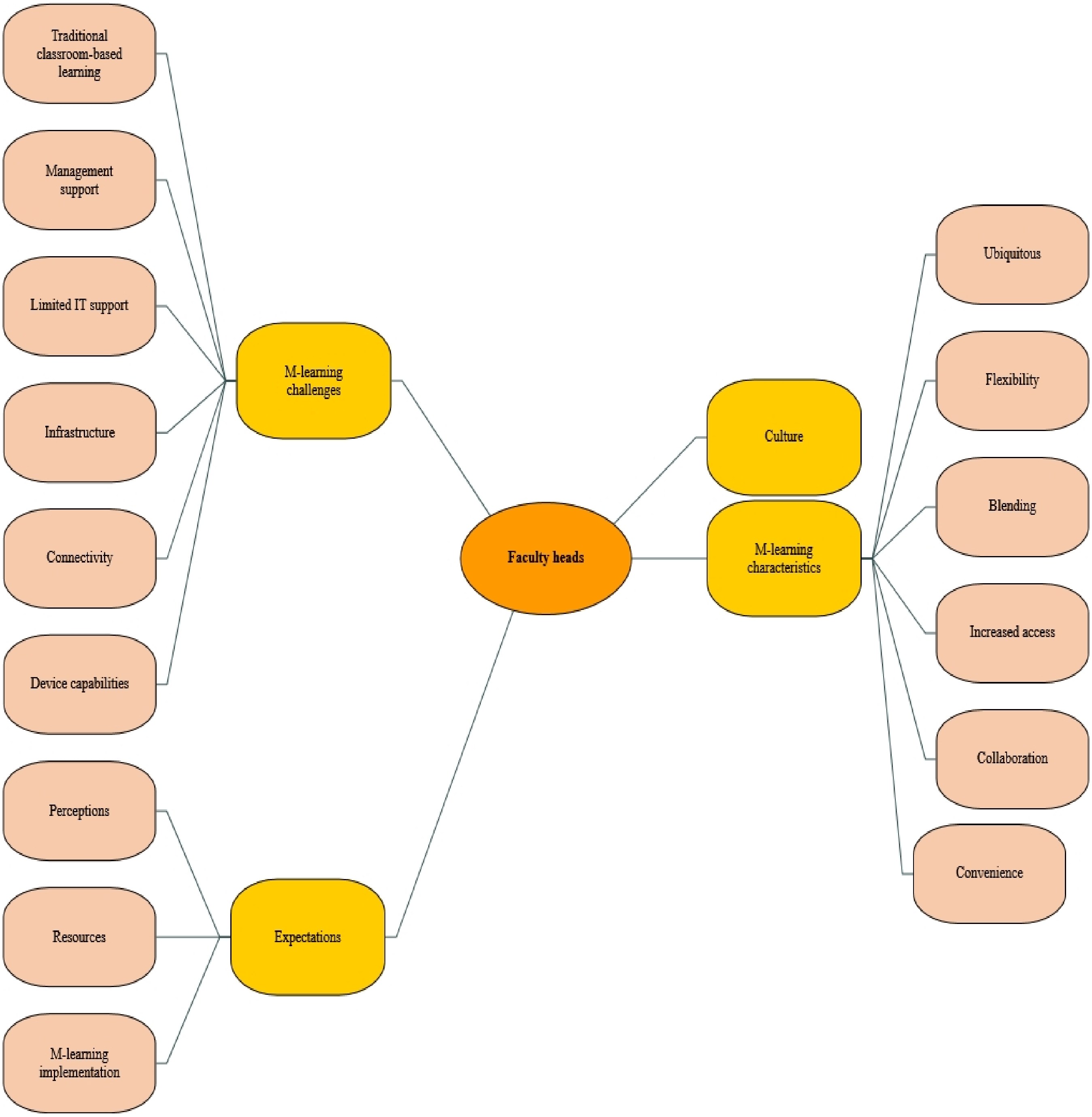


Figure 4. 10 Set of themes - **Faculty heads** (prepared by researcher)

4.4.3 Searching for themes

The themes that emerged based on the literature and the data collected from the faculty heads (Figure 4. 11) are:

- Culture
- Characteristics of m-learning

- Staff expectations
- Challenges of implementing m-learning

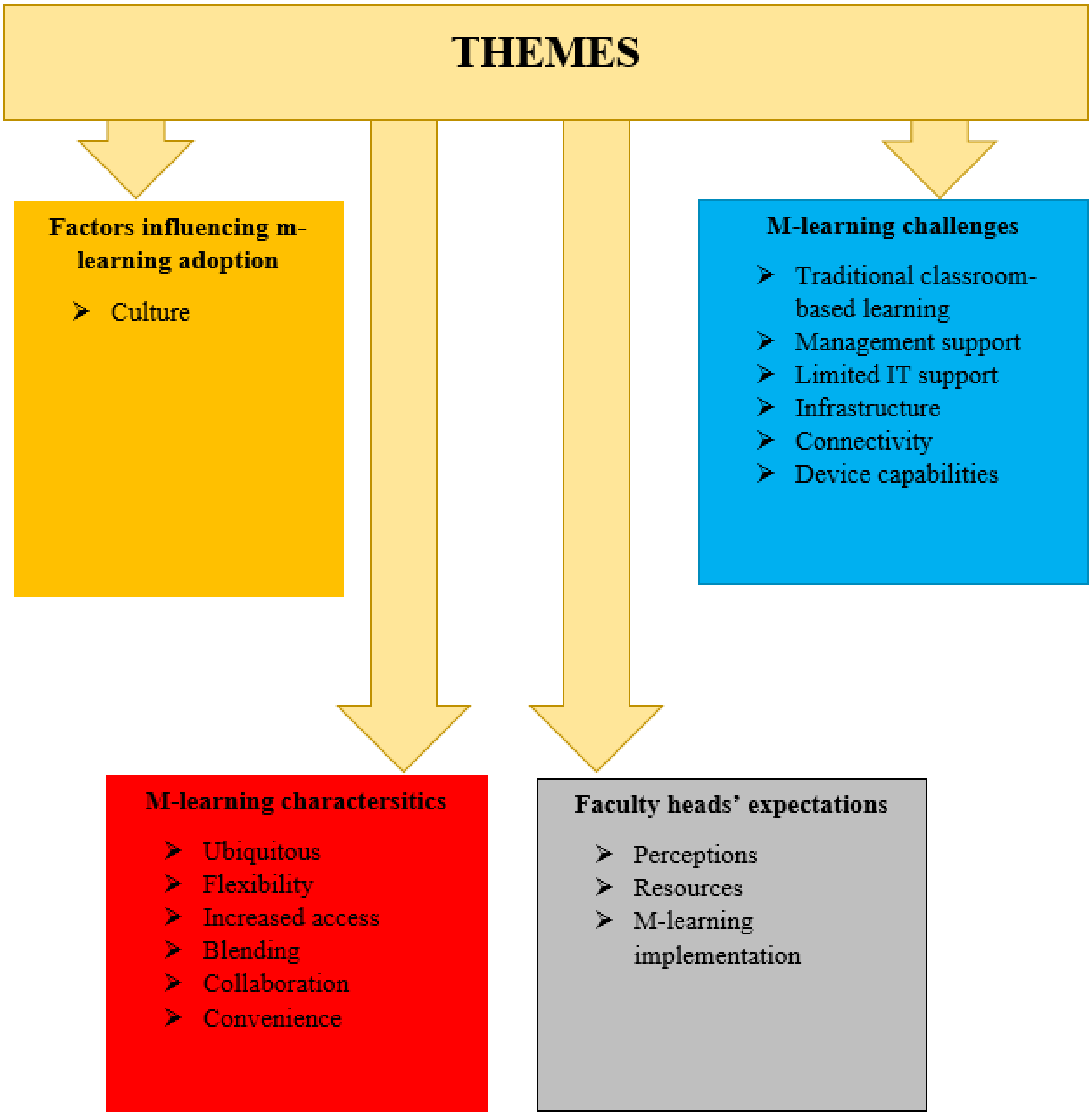


Figure 4. 11 Themes and sub-themes derived from interview questions and data collected from the **Faculty heads**

4.4.4 Theme 1: Culture

Culture has been noted to affect m-learning adoption particularly, in developing countries (section 2.9.4). All the heads of various departments in the tertiary institutions fully embrace mobile devices as teaching and learning tools and are interested in incorporating m-learning in courses offered by their institutions. There is an eagerness for m-learning which may be a shift from the way that mobile technologies were perceived previously. The prevalence of mobile devices is possibly an easier avenue of integrating ICT with education in Zimbabwe.

One faculty head indicated that in some institutions mobile technologies have been already accepted and there is an expectation that m-learning would be readily accepted at his university. However, it was suggested that while m-learning would be accepted, there would be need for change as most institutions are currently mainly classroom-based. This presents a challenge regarding the amount of change that will be required to move from an entirely classroom-based learning mode which has a long tradition, to a new pedagogy that incorporates m-learning and requires a cultural change. There is an indication by some faculty heads that some students perceive mobile technologies as learning tools. It remains essential to fully explore how both learners and academic staff perceive mobile technologies in relation to teaching and learning as suggested by (Pouezevara 2015). In lesser researched contexts like Zimbabwe, it may be that the students who embrace m-learning may not be representative of the general student population, which would affect m-learning adoption. While there is evidence that faculty heads are enthusiastic about m-learning, they have concerns regarding the change from fully classroom-based learning to m-learning. This change may not be welcome by all faculty heads and other academics, and this would have an impact on m-learning adoption and implementation. Some comments made by faculty heads in relation to culture are presented in in Table 4. 16.

Table 4. 16 Faculty heads' comments on culture

Respondents	Comments
Faculty_head_1	○ *"Mobile learning is slowly becoming popular among students.* ○ *"The students are picking up applications that are useful for their studies, however awareness of m-learning is generally low among students."*
Faculty_head_3	○ *"[m-learning] enables integration of ICT in teaching and learning."*
Faculty_head_7	○ *"In Zimbabwe m-learning has been accepted by some learners and trainers while some may take some time to accept the concept."* ○ *"The concept [m-learning] would need to be assimilated well into the current operations considering the amount of change required to an institution that has been running classroom based learning for many years."*

4.4.5 Theme 2: Characteristics of m-learning

There are a number of m-learning characteristics that can be exploited for learning purposes (section 2.8.1).

4.4.5.1 Ubiquitous

A key aspect of m-learning is its ubiquity (section 2.8.1.3). The comments made by faculty heads suggest that mobile devices are prevalent in Zimbabwe, with most Zimbabweans relying on mobile devices for financial transactions, information sharing, exchange of health tips, and students picking up applications relevant to their studies. In regard to student ownership of and access to mobile devices, half of the faculty heads reported that most students use mobile technologies; these faculty heads suggest that mobile devices would be handy tools for teaching and learning. The comments on ubiquity are presented in Table 4.15.

The findings broadly support the work of other studies that indicate that most people looking for a computing platform turn to mobile devices as a first choice as they enable ubiquitous access to information, because of their portability (New Media Consortium 2011; Chen, Chang and Wang 2008). Faculty heads believed that most students have access to mobile devices as indicated in Table 4.17. Faculty heads felt that most university students have a mobile device that is suitable for teaching and learning purposes.

Table 4. 17 Faculty heads' comments on ubiquity

Respondents	Comments
Faculty_head_1	○ *"Mobile devices have become more of goods of convenience not a luxury for the majority of people in Zimbabwe.* ○ *"A larger proportion of our students own mobile devices (smart phones and tablets) than those who own both mobile devices and stationary / laptop computers."* ○ *"The Zimbabwean population relies on mobile devices (mobile phones and tablet computers) to pay bills, send money to their loved ones, share handy information and even lighter moments (pictures, videos, jokes etc.), for exchange of tips on health and for other uses (including as a tool for disaster awareness, religious information etc.)."*
Faculty_head_7	*"Our institution is comprised mostly of the younger generation, the use of mobile technologies has been accepted by the majority of these."*
Faculty_head_8	*"Every student has a mobile phone hence it it's a powerful tool in teaching and learning."*

4.4.5.2 Flexibility

A major and unique feature of mobile technologies is that it offer learners in higher education flexibility (section 2.8.1.8). Faculty heads are positive about the flexibility offered by m-learning. They support the idea that flexibility offered by m-learning gives a major advantage to both learners and educators. Interestingly, one faculty head pointed out that the flexibility should be coupled with university and industry standards. The standards of learning institutions and industry standards would refer to standards of higher education. These standards it may be suggested would encompass learning theories to ensure the flexibility allows for effective and successful learning. Flexibility should consider the challenges students may encounter as they move in different contexts which may impact on the learning process. Flexibility is a key construct in m-learning design, so it may be concluded that when implementing m-learning, it is important to:

1. Incorporate learning theories to enable students achieve their learning goals.
2. Consider the challenges of interruptions that may occur as students access learning resources in their chosen locations and at their chosen time.

These findings are consistent with previous studies that assert that flexibility is a cornerstone of m-learning, which enables students to have autonomy over their learning content as well as control over the place, pace and time they learn (Crescente and Lee 2011; Kearney et al. 2012).

Since tertiary institutions are comprised of heterogeneous students with varied learning styles and learning approaches mobile technologies could be the ideal tool in accommodating the differences through personalisation. The comments made by faculty heads in regard to flexibility are presented in Table 4.18.

Table 4. 18 Faculty heads' comments on flexibility

Respondents	**Comments**
Faculty_head_2	*"It can allow students who would have missed lectures to easily catch up"*
Faculty_head_3	○ *"Teaching and learning will be paced at teacher and learner's convenience, when a student is not the mood he/she can learn when ready."* ○ *"This allows students to ask individual questions without exposing ignorance in public."* ○ *"When a student is not in the mood he/she can learn when ready."*
Faculty_head_4	*"M-learning is flexible, students can download material and study later."*
Faculty_head_5	*"[M-learning flexibility] should meet the required standards for industry and learning institutions."*
Faculty_head_6	*"It [m-learning] allows flexibility"*
Faculty_head_7	*"The flexibility works well and gives an advantage as students can learn from anywhere."*

4.4.5.3 Increased Access

M-learning has the potential to provide more access to information. Some faculty heads acknowledge that m-learning improves students' access to information. The department heads perceive m-learning as a means for learners to obtain more current information. Some faculty heads reported that educational resources will no longer be obtained from the physical brick and mortar location only, with other faculty heads suggesting that students will have more opportunities to interact with the lecturers. These findings broadly support the work of other studies that link m-learning to increased access to educational resources (Asiimwe and Grönlund 2015; Osang, Ngole and Tsuma 2013). It is not surprising that m-learning will increase access to learning materials, which is important in resource-constrained environments. Faculty heads' comments on increased access are presented in Table 4. 19.

Table 4. 19 Faculty heads' comments on increased access

Respondents	Comments
Faculty_head_3	*"There is an information boom, thus student is exposed to current information"*
Faculty_head_6	○ *"Wider accessibility to information classes will be conducted outside the traditional confines of a physical venue."* ○ *"[Use of mobile devices] will increase access between teacher and student, so there is a greater possibility of work being checked more frequently on its progress."*
Faculty_head_8	*"M-learning enhances access."*

4.4.5.4 Blending

Blended learning is discussed in section 2.8.1.4. Faculty heads are keen to embrace m-learning to complement the traditional face-to-face method of teaching. One faculty head felt there is a need for guidance by the instructor; similarly, another member of the faculty indicated that there are some elements of learning like practical work that require face-to-face interactions with students.

One faculty head stated that he would take up m-learning to allow for blending with other methods of teaching and learning. Another faculty head felt m-learning should be introduced as a supplement to traditional methods with another faculty head echoing the same sentiments and suggesting m-learning should be introduced gradually. The findings in this study are consistent with those of previous studies which show that blended learning can be beneficial and maximise both face-to-face and online methods, making the learning more rigorous and fruitful (Imtinan, Chang and Issa 2013; Ocak 2011). The suggestion of a gradual introduction means the step-by-step introduction would facilitate blended learning. Table 4.20 indicates the importance of blending in m-learning from the perspective of faculty heads.

Table 4. 20 Faculty heads' comments on blending

Respondents	Comments
Faculty_head_3	○ *"There is need for guidance by teacher."*
Faculty_head_4	○ *"To allow for blended learning."* ○ *"It should be introduced as complementary or supplement traditional methods."*
Faculty_head_5	○ *"Practical work has to be done face-to-face with students as demonstrations have to be carried out.*
Faculty_head_7	○ *"The introduction of m-learning has to be introduced in a piecemeal fashion to enable monitoring, review and acceptance."*

4.4.5.5 Collaboration

Collaboration is discussed in section 2.8.1.5. Surprisingly, only one faculty head touched on this issue.

[Faculty_head_2]: *"It [m-learning] will allow them [learners] to easily collaborate."*

The use of mobile technologies means that learners can undertake learning activities and share knowledge through interaction and negotiation.

4.4.5.6 Convenience

Mobile technologies offer a great deal of convenience to both learners and educators. Some of the faculty heads in Zimbabwe universities see and appreciate the degree of convenience from both the learner's and instructor's perspectives. Faculty members discussed the convenience of m-learning in terms of: (1) saving time (2) faster way of disseminating information and resources (3) making research work easier (4) easier data collection (5) learners and instructors not having to be at a set physical location to attend classes, and (6) learning and teaching paced to suit the instructor and the student.

Comparison of these findings with those of other studies confirm that convenience is a motivating factor for m-learning for both learners and faculty members. Literature shows that learners are interested in m-learning because of its convenience (Alowayr and McCrindle 2017; Cheng 2015; DeWitt, Siraj and Alias 2014; Iqbal and Bhatti 2016). A study by Schuck et al. (2013) of community university lecturers, revealed that convenience is an advantage of m-learning for instructors. It is important to utilise the strengths of the mobile technologies as it is highly likely that both faculty and learners will embrace m-learning because of the convenience offered by the portability of mobile technologies. Faculty heads perceive m-learning as convenient. The convenience of using m-learning is perceived from different angles by the faculty heads as illustrated in Table 4. 21.

Table 4. 21 Faculty heads' comments on convenience

Respondents	**Comments**
Faculty_head_2	*"Research will become easy and allow collection of data as much as possible."*
Faculty_head_5	*"It [m-learning] is a faster method of spreading information, notes, assignments and tests."*
Faculty_head_6	*"A teacher may not necessarily need to be in class to deliver teachings as well as the students.*
Faculty_head_3	*"Teaching and learning will be paced at teacher and learner's convenience"* *"When a student is not the mood he/she can learn when ready."*
Faculty_head_6	*"It allows for flexibility and saves time."*

4.4.6 Theme 3: Faculty heads' expectations

Most research focuses on student attitudes towards m-learning, with fewer studies concentrating on other m-learning stakeholders' attitudes. The faculty heads in Zimbabwe tertiary institutions have varied expectations regarding m-learning implementation. These expectations comprise:

1) Perceptions
2) Resources
3) M-learning implementation

4.4.6.1 Perceptions

The faculty heads in Zimbabwe tertiary institutions are keen to embrace m-learning. There are suggestions that m-learning will be greatly embraced. It is anticipated that m-learning will be more useful than computers to Zimbabwean students. There is a suggestion that mobile devices would have the greatest impact amongst ICT tools in African universities. One faculty head suggests that m-learning would advance institutions' agenda of e-learning which is consistent with the universities' mandate to develop Science and Technology. These findings are supportive of studies that suggest that m-learning has become attractive in developing countries because of the cheaper costs of mobile devices (Iqbal and Qureshi 2012; Fatima et al. 2019).

Although cheaper mobile devices make m-learning attractive, cost is a relative issue, particularly in countries facing socio-economic challenges.

4.4.6.2 Resources

Faculty heads reported that currently there are inadequate resources for m-learning. There are suggestions from some faculty heads that the higher education institutions should provide technical support and the necessary resources such as IT infrastructure to get m-learning under way. One faculty head points out the need for funding for the requisite hardware and software for successful m-learning implementation. These findings reflect those of (Asiimwe, Grönlund and Hatakka 2017; Oyelere and Suhonen 2016). In developing countries, a lack of resources can be a major obstacle to m-learning.

4.4.6.3 M-learning implementation

Policy can shape visionary plans and provide pathways to a better world (section 2.9.3). One faculty head points out the need for supporting policies when implementing m-learning in Zimbabwe. This observation corroborates the findings of (Chitiyo and Harmon 2009; Asabere 2013; Barker, Krull and Mallinson 2005) who assert that m-learning implementation success depends on necessary policies being in place. With developing countries that do not have mature policies on m-learning, there may be a need to investigate and adopt policies formulated in developed countries but adapted to suit the developing country contexts. While it is clear that the policy details will need to address conflicting demands and constraints, the different socio-economic circumstances and cultures of the various developing countries will need to be taken into consideration as well. M-learning success depends on establishing comprehensive ICT policies that are clearly defined and backed by well-resourced strategies. Effective policies should be supported by relevant stakeholders who embrace and understand the policies.

Management plays a significant role in m-learning implementation in tertiary institutions. According to some faculty heads in Zimbabwe tertiary institutions, the success of m-learning implementation will depend on promoting wider uptake of mobile technologies and lobbying to get management buy-in. These findings align with suggestions that the seamless integration of technology with education in a faculty requires clear policy, financing, training, technical support and commitment from senior management in tertiary institutions (Iqbal and Bhatti 2016; Al-Hunaiyyan, Alhajri and Al-Sharhan 2016). Implementing m-learning in tertiary institutions requires managing the change within the institutions, given the various views and attitudes towards integrating technology with education. Even with management support, m-learning implementation and adoption will be a major change for the tertiary institutions and the various stakeholders, so change management techniques will need to be employed to ensure a smooth transition.

There are suggestions from some of the faculty members in Zimbabwe that m-learning implementation should be done gradually, to complement traditional face-to-face teaching. The faculty heads added that this would allow for monitoring, acceptance and evaluation. This confirms the findings of Annan, Ofori-Dwumfuo, and Falch (2018) who suggest pilot studies for m-learning projects in developing countries. It is interesting to note that the faculty members in Zimbabwe are keen on monitoring and evaluating m-learning. M-learning increases additional challenges for evaluation of both the technology and the learning outcome Al-Hunaiyyan, Alhajri, and Al-Sharhan (2016). Al-Hunaiyyan, Alhajri, and Al-Sharhan (2016) further claim that m-learning increases the complexity of the evaluation process, forcing educational institutions to consider m-learning pedagogical issues, technical capabilities, cultural and social factors. It seems that Zimbabwe faculty heads are keen to obtain evidence regarding the effective use of mobile learning in education.

Although the potential benefits are clearly explained in the literature, there is need to have evidence regarding effective use of m-learning in education, particularly in developing countries for widespread adoption, given the limited resources and the budget required for m-learning implementation. Table 4.22 shows that the faculty heads in Zimbabwe universities are ready to embrace m-learning although there are issues that need to be addressed to ensure the successful implementation and adoption of m-learning.

Table 4. 22 Faculty heads' comments about their expectations

Respondents	Comments
Faculty_head_1	◦ *"M-learning will be more useful to Zimbabwean students than computers."* ◦ *"What is needed is promotion of the wider uptake of the mobile technologies."* ◦ *"M-learning would have greatest effect among ICT tools at an African university."*
Faculty_head_2	◦ *"It [M-learning] will be greatly embraced."* ◦ *"It [m-learning] will advance the university agenda of e-learning. Thus, also collaborating with the universities' mandate, science and technology."* ◦ *"It [university] has to provide the platform the resources and technical support to spearhead the program."*
Faculty_head_3	◦ *"Funding for both hardware and software needs to be availed."* ◦ *"Supporting policies should be crafted."*
Faculty_head_4	◦ *"There is need for lobbying first to get management buy in."* ◦ *"It should be introduced as complementary or supplement traditional methods."*
Faculty_head_6	*"Largely institutions should provide to a greater extent the IT infrastructure and other accessories as you note mobile devices success in teaching depend largely on the quality of the infrastructure."*
Faculty_head_7	*"The introduction of m-learning has to be introduced in a piecemeal fashion to enable monitoring, review and acceptance."*

4.4.7 Theme 4: Challenges of implementing m-learning

There are a number of challenges that affect the implementation of m-learning projects especially in developing countries. Section 2.9 explores a wide range of challenges to m-learning comprising infrastructural, technical, institutional, social and cultural issues. According to the faculty heads, m-learning challenges include those associated with the current traditional classroom-based learning, infrastructural issues, the need for management support, lack of IT support and the inherent problems of mobile technologies.

4.4.7.1 Infrastructure

Infrastructure remains a major obstacle to m-learning, particularly in developing countries as explained in section 2.9.1. The faculty heads suggested that m-learning success will depend greatly on quality infrastructure, particularly for IT. One faculty head commented that there is a need for necessary accessories and the availability of Internet connectivity, with another faculty head pointing out the need for funding to purchase the requisite hardware and software.

4.4.7.2 Transition from classroom-based learning

M-learning has the potential to provide new and different ways of learning. Some concerns raised by faculty heads are related to the transition from an entirely traditional classroom-based learning to m-learning. The traditional classroom-based learning assumes a delivery model, in which the instructor is charged with the knowledge and authority to distribute knowledge to passive learners (Tanner 2000). In traditional classroom-based institutions, learning occurs at set times, and may not value learning outside these times. This may be inconsistent with the spontaneous and incidental nature of m-learning (Schuck, Kearney and Burden 2017). The change from a traditional face-to-face approach will need to be managed carefully with stakeholders being made aware of the benefits of m-learning.

Another issue raised by faculty heads was that, with a few exceptions, most students required constant guidance and encouragement from their lecturers. This seems to be an indication that a majority of the learners are not ready for self-study, which could be linked to the traditional classroom-based learning that does not recognise that learners can be contributors of knowledge.

Faculty heads also raised concerns that the use of mobile technologies required discipline. It was noted that students needed to separate learning from entertainment. This suggests distractions and lack of concentration on the students' part. This observation by faculty heads corroborates earlier findings that distraction is a major disadvantage as students engage in non-academic activities on mobile devices (Delello, Reichard and Mokhtari 2016; Scott et al. 2017). Mobile devices have features purely for entertainment and pleasure, and it is natural that those who have the devices would want to explore those features. With learners new to m-learning, it may prove to be a challenge to have the discipline to fully concentrate on academic work particularly where mobile devices have been used exclusively for non-academic activities. If mobile technologies continuously distract students from their learning, this can be a major obstacle as faculty heads and academics in general may not see the benefit of adopting m-learning. In traditional classroom-based learning, instructors may feel they have more authority in ensuring students are more focussed on their studies as they deliver the learning material.

4.4.7.3 Management support

Although faculty heads are keen to embrace m-learning, there is an indication that there is need for support from management and the technical support team, the lack of which will present an obstacle to m-learning implementation as discussed in section 2.6.6.

4.4.7.4 Device issues

Device capabilities present a challenge to m-learning implementation according to the faculty heads. One faculty head indicated that it was important to consider the type of data to be communicated. Another faculty head noted that some specific tasks could not be performed on mobile devices given the computing limitations of the devices. The issues highlighted by the faculty heads are supportive of the work by (Yousafzai et al. 2016) who suggest that the modelling of educational content on mobile devices and m-learning platforms can be hindered by technical issues which need to be addressed to achieve seamless learning. It is apparent in Table 4.23 that academic faculty heads are concerned about technical issues related to m-learning as well as the way that students can adapt to this mode of learning.

Table 4. 23 Faculty heads' comments on challenges to m-learning implementation

Respondents	Comments
Faculty_head_1	*"Certain tasks e.g. Bioinformatics would not be possible bearing in mind the limited capacity of the mobile devices."*
Faculty_head_7	*"The "normal" mode of study is classroom based there would be a need to monitor the transition to self-study. A lot of discipline is required to enable self-study."*
Faculty_head_7	*"That is true for that particular student who is curious, inquisitive and motivated. The rest of the student body that requires constant guiding and encouragement would miss this additional information."*
Faculty_head_7	*"Creating the required discipline to separate learning and entertainment."*
Faculty_head_7	*"Attention has to be paid to the kind of data that is communicated considering the complexity in terms of format for some subject areas. Text and pictures are easily accommodated unlike executables."*

4.4.8 New findings

The new findings from the data provided by faculty heads were compared to the items in the initial model (Table 4.24). Similarities in the initial proposed model and the data are depicted by black double-pointed arrows. Where the data collected contradicts what was in the initial proposed model a red arrow is used with new findings emerging from the data shown in italics. The initial model and findings from the data collected suggest that infrastructure, investment costs and policies are key m-learning challenges.

New findings emerged from the collected data. Interestingly, the change from classroom-based learning to m-learning was identified as a challenge. Other additional challenges identified by the faculty heads included students' lack of preparedness for self-study, lack of management support, the different capabilities of the mobile devices and the distraction from academic work that could result from m-learning.

There were new findings in terms of faculty heads' expectations: they wanted management's acceptance and support, and adequate resources. Faculty heads would prefer that m-learning be gradually introduced in stages. The most interesting expectation was that faculty heads would like monitoring and evaluation of m-learning activities. This may suggest that the faculty heads are not just keen on integrating ICT with education but want to be able to measure the benefits of this mode of learning.

Some characteristics that emerged from the data collected from the faculty heads include flexibility, convenience, personalised learning and increased access. Flexibility and convenience were noted to be advantageous to both learners and instructors. It was reported that the flexibility offered by m-learning should be intertwined with learning institution standards.

Table 4. 24 Findings from faculty heads' data

Main aspects in initial proposed model	**New Findings in data collected**
M-learning challenges	**M-learning challenges**
Infrastructure	Infrastructure
Investment costs	Investment costs
Policies	Policies
	Transitioning from classroom-based learning to m-learning
	Most learners not ready for self-study
	Distraction from academic work
	Management support
	Device capabilities
Factors influencing m-learning adoption	**Factors influencing m-learning adoption**
Culture	Culture
Cheaper mobile phones	Cheaper mobile phones
HCI	HCI
Pedagogy	
Learners' expectations	
Administrators' expectations	
Learning theories	**Pedagogy**
	Learners' expectations
	Administrators' expectations
	Institutions should provide support and resources
	Management support
M-learning characteristics	*Piece-meal implementation*
Portability	*Monitoring and evaluation*
Blending	Learning theories
Collaboration	
Training	
Usability	
Connectivity	**M-learning characteristics**
Ubiquity	Portability
Technical support	Blending
Interactivity	Collaboration
Context	Training
Mobility	Usability
	Connectivity
	Ubiquity
	Technical support
	Interactivity
	Context
	Mobility
	Flexibility
	Convenience
	Personalised learning
	Increased access

Legend	
double pointed black arrow = similar findings from data and model	
red arrow= findings from data contradict initial model	
italics = new finding from data collected	***italics***
normal print = aspects in the intial model not discussed in data collected	normal print, no arrows, no italics

4.5 Lecturers

Sampling for the lecturers was random and the resultant sample is shown in Figure 4.12.

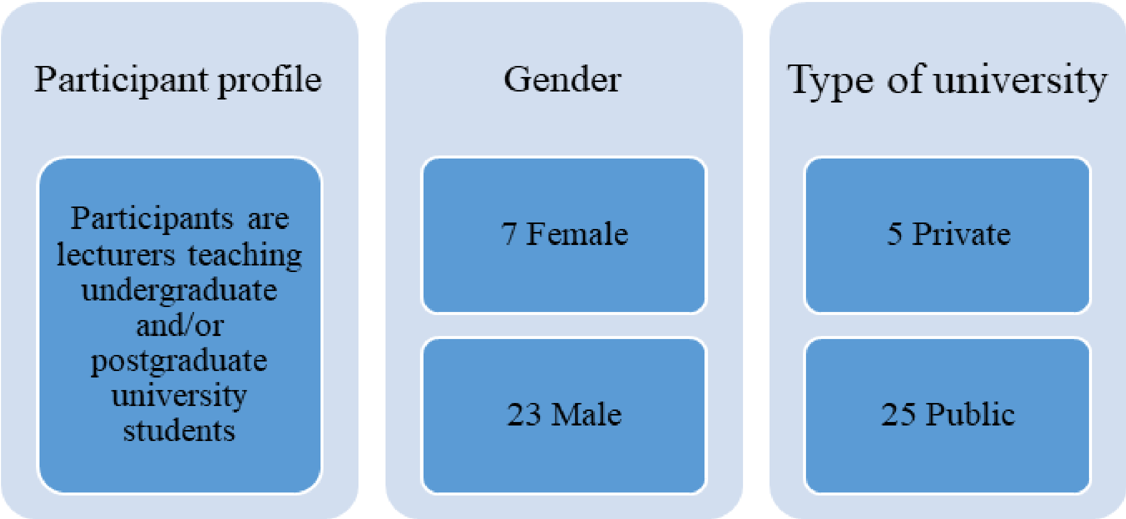


Figure 4. 12 Sampling of university lecturers

4.5.1 Familiarisation with the data

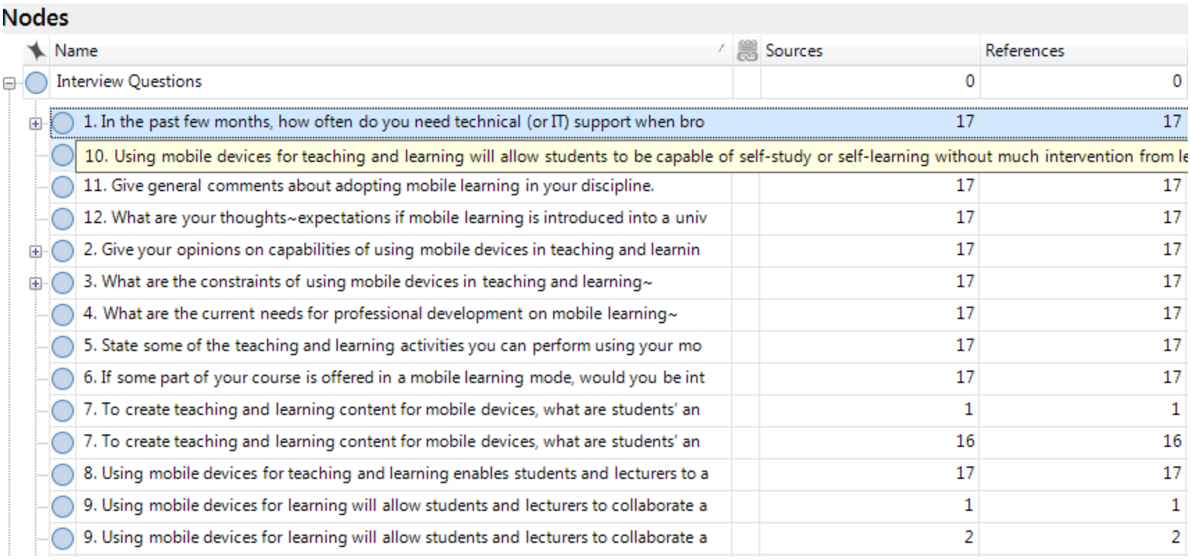
Responses from the lecturers came in different forms. Some lecturers responded via email, others chose to complete the online survey, while others preferred to print the questions and answer them using pen and paper before sending the scanned copies. To familiarise herself with the data from the university lecturers, the researcher read and reread the qualitative responses a number of times and made notes. The notes were made to record a first impression of the lecturers' attitudes towards m-learning, and to capture the essential information before analysing the data. Notes were made for each of the respondents to obtain an idea of the data provided by each of the respondents. Appendix H shows the first-impression notes on the lecturers' interview data. The respondents were identified using a code instead of their actual names.

The data collection involved sending emails to the potential participants who are lecturers in Zimbabwe universities. The emails were sent between February and March of 2018. A total of one hundred and seventy-eight (178) emails were sent to one hundred and seventy-eight lecturers in the various tertiary institutions. Follow-up emails were sent after two weeks when there was no response. Each response was read on receipt, and notes made of first impressions. Two respondents printed the questions, used pen to write their answers, scanned the pages and emailed them back to the researcher. Eleven lecturers responded via the online link on Qualtrics with the remaining seventeen respondents opting to respond by giving their responses on the Word document and emailing that back. Some participants provided more details than others in their written responses. There were fifty-eight pages of the responses containing the interview data comprising of 6,388 words.

Reading and becoming familiar with the data took about sixteen hours in total for the thirty participants, as the transcripts were read line by line. NVivo 12 Pro was used for data interpretation.

4.5.2 Generation of initial codes

The generation of initial codes was done using NVivo 12 Pro. Figure 4.13 shows a screenshot from NVivo for initial coding.



Nodes

Name	Sources	References
Interview Questions	0	0
1. In the past few months, how often do you need technical (or IT) support when bro	17	17
10. Using mobile devices for teaching and learning will allow students to be capable of self-study or self-learning without much intervention from le		
11. Give general comments about adopting mobile learning in your discipline.	17	17
12. What are your thoughts~expectations if mobile learning is introduced into a univ	17	17
2. Give your opinions on capabilities of using mobile devices in teaching and learnin	17	17
3. What are the constraints of using mobile devices in teaching and learning~	17	17
4. What are the current needs for professional development on mobile learning~	17	17
5. State some of the teaching and learning activities you can perform using your mo	17	17
6. If some part of your course is offered in a mobile learning mode, would you be int	17	17
7. To create teaching and learning content for mobile devices, what are students' an	1	1
7. To create teaching and learning content for mobile devices, what are students' an	16	16
8. Using mobile devices for teaching and learning enables students and lecturers to a	17	17
9. Using mobile devices for learning will allow students and lecturers to collaborate a	1	1
9. Using mobile devices for learning will allow students and lecturers to collaborate a	2	2

Figure 4. 13 Lecturers' initial coding

4.5.3 Searching for themes

Initial searching of the themes was both theory- and data-driven. An example of the generation of initial codes based on the statements from the data collected from the lecturers is shown in Table 4. 25.

Table 4. 25 Generation of initial codes-lecturers

Statement	**Code(s)**
Distraction from other Apps e.g. WhatsApp	Distraction
It works fairly well with self-actualised students, those who depend on supervision it might not work.	Self-learning
Training of the tutors in use of the devices, installations of applications, linking these devices to institutional servers or databases that can be faced with resistance from the management.	Training
There is huge potential especially where there is access to high speed internet facilities and where there is discipline on the use of the devices.	Infrastructure Discipline
Students may divert to other uses e.g. WhatsApp. Availability of mobile phone may also be a challenge since students come from different backgrounds and have different resources endowments.	Distraction Availability of devices
There is need to enhance the technical competencies of the teachers through training (on the job training), especially the older generation who were born before computers/mobile devices and the internet. For the students nothing very much more than induction in the majority of cases. Not too sure though about the level of literacy in the rural areas.	Training for lecturers Training for students
Given what our students have been exposed to through mobile devices, chances are high they may easily switch to other applications thus affecting what is to be learn at that particular time. Not all students may afford the mobile devices.	Distraction Affordability of mobile devices.
Provide adequate support technically is availed and also provision of the necessary hardware.	Technical support. Infrastructure
Reception would depend on planning (piloting, demonstration, participation) and resources (devices, broadband internet access, and constant human and technical support).	Infrastructure Technical support

Both the theory-driven and data-driven codes are shown in Figure 4.14.

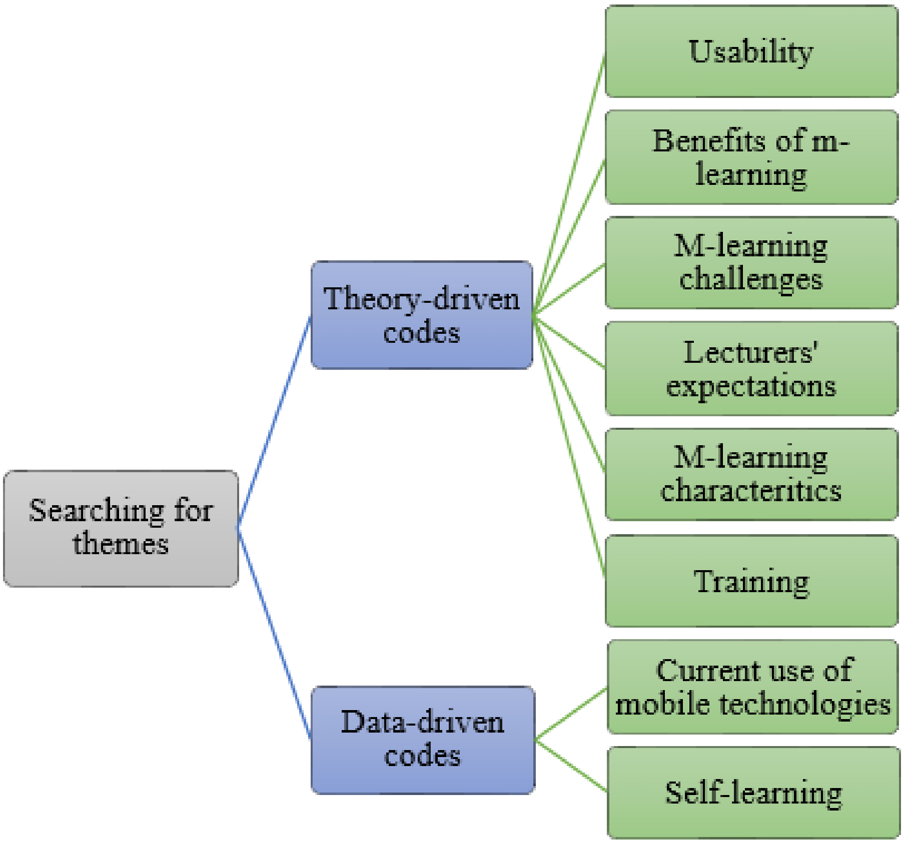


Figure 4. 14 Theory-driven and data-driven codes (by researcher)

The first set of themes from the data collected is presented in Figure 4.15.

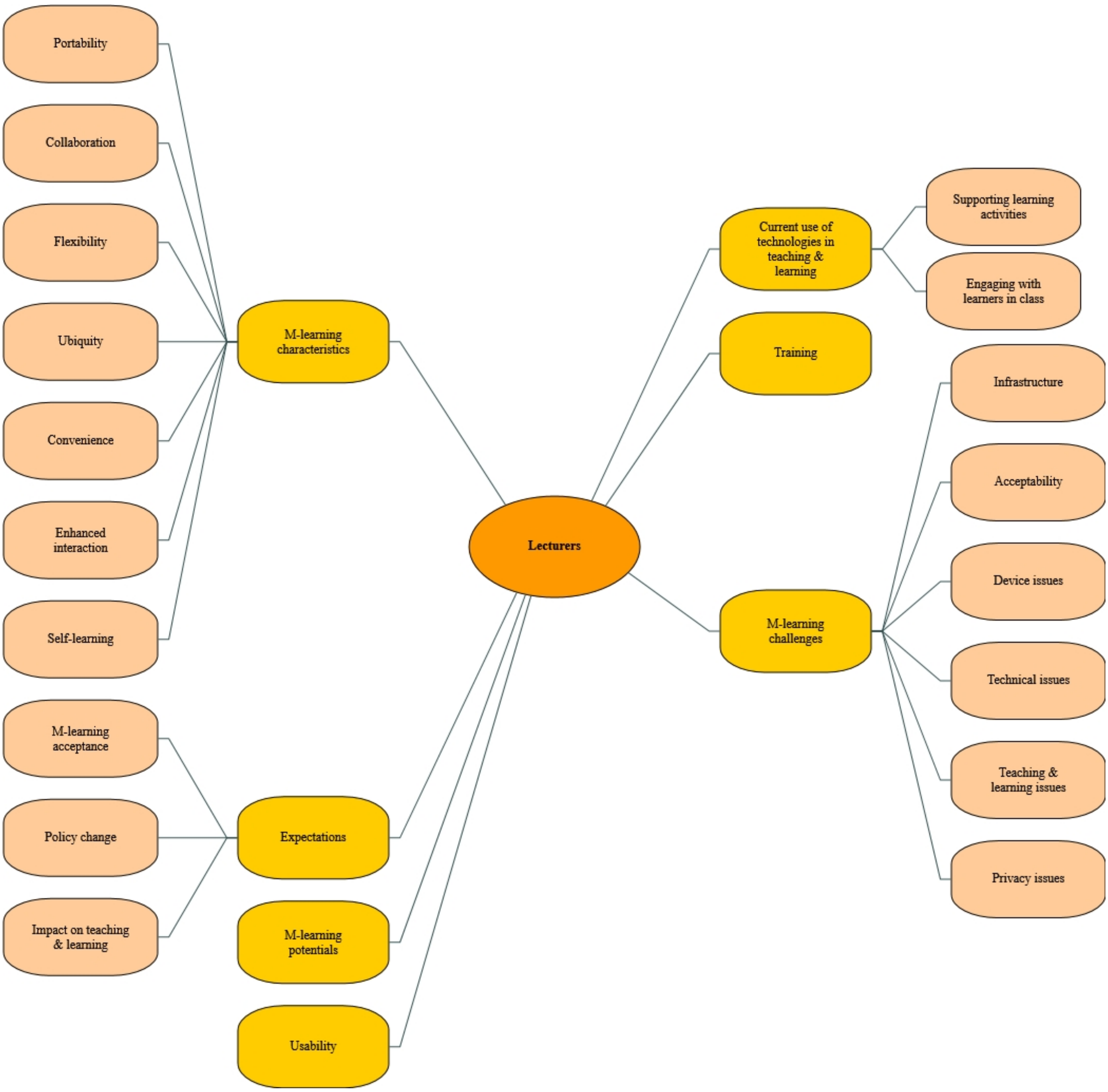


Figure 4. 15 First set of themes - Lecturers (by researcher)

4.5.4 Revision of themes

The resulting themes after reviewing the initial themes are presented in Figure 4. 16.

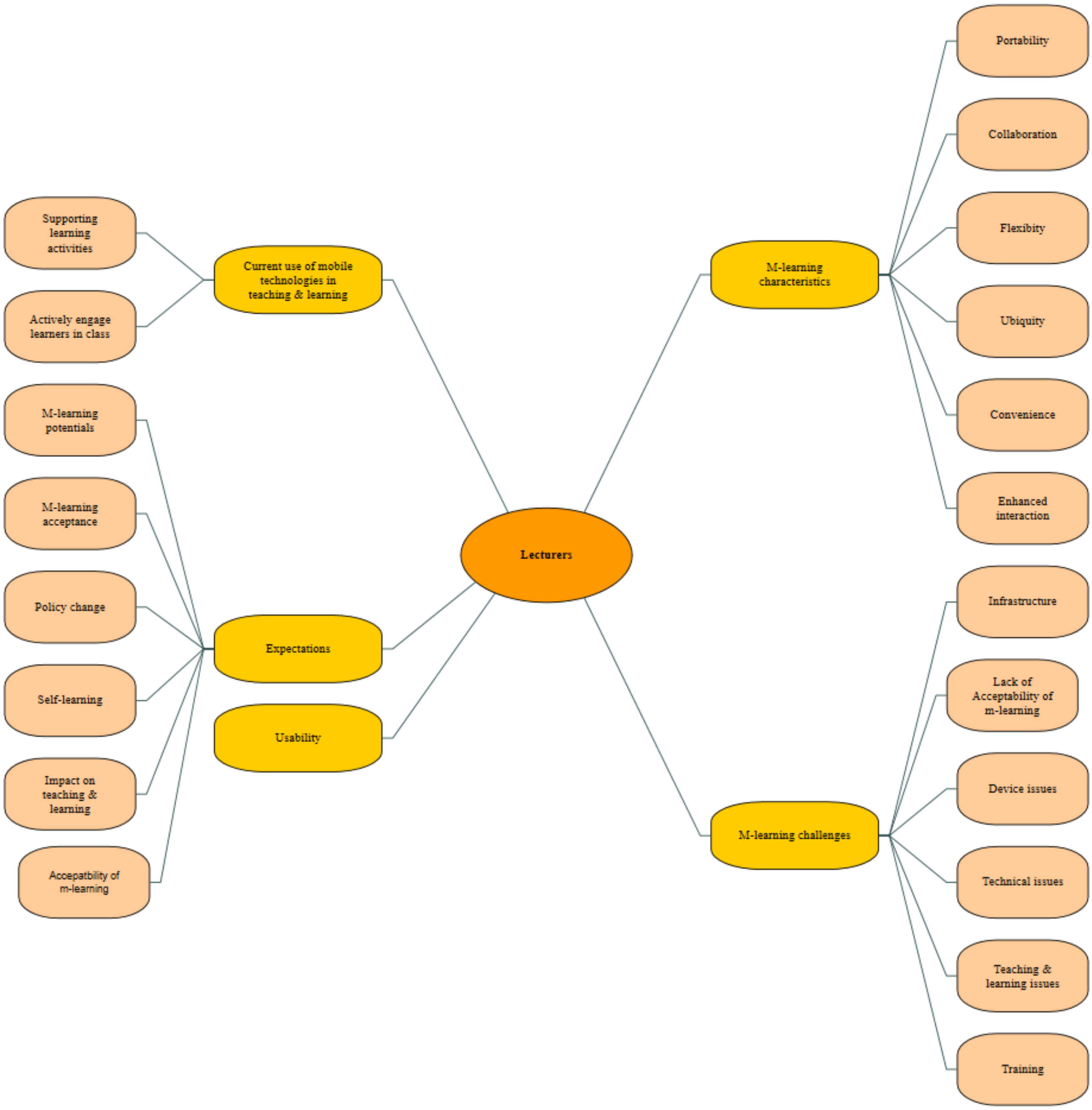


Figure 4. 16 Revision of themes - **Lecturers** (prepared by researcher)

4.5.5 Themes

The themes that emerged from the narratives of the lecturers (Figure 4. 17) were:

- Usability
- m-learning characteristics
- Current use of mobile devices in teaching and learning
- m-learning challenges
- staff expectations

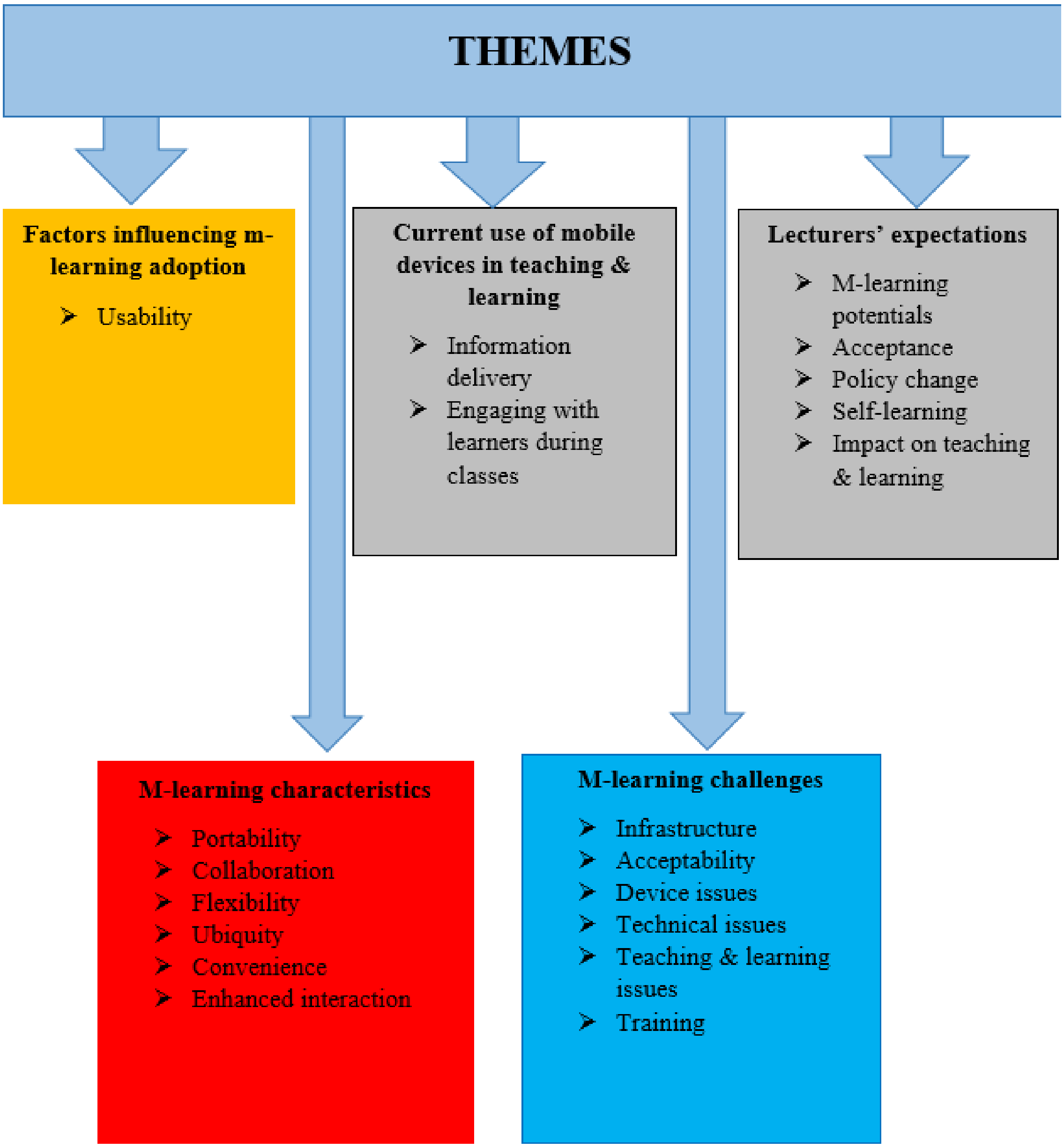


Figure 4. 17 Themes and subthemes emerging from lecturers' data

4.5.6 Theme 1: Usability

For mobile technology to be successful as an educational platform, the issue of usability must be considered. Usability as a factor affecting m-learning adoption is discussed in section 2.8.1.9. Lecturers reported that they did not need technical assistance or support when using their mobile devices. Most of these lecturers mentioned that they have never asked for technical support or assistance when using their mobile devices. The minority that required assistance with using their mobile devices reported that they required technical support not on a regular basis, with one lecturer stating he required assistance at least once a week. One lecturer suggested that there is a need for user-friendly devices. The ease of use of mobile devices by lecturers in Zimbabwe tertiary institutions could be attributed to various factors such as: (1) mobile phone manufactures continuously seeking to improve the user experience; (2) simplicity in designing the user interface in mobile devices (Nielsen 1999), (3) users are no longer bound to a single platform but can access content on various platforms like their phones, tablets and PCs. The different implementations mean developers have a better understanding of how their designs can incorporate usability and functionality (Kortum and Sorber 2015).

4.5.7 Theme 2: Characteristics of m-learning

Literature shows a wide range of m-learning characteristics as explored in section 2.8.1. The characteristics of m-learning that emerged from this study are discussed below.

4.5.7.1 Collaboration

Collaboration is discussed in section 2.8.1.5. Several lecturers highlighted that collaboration was an important aspect of m-learning, and that this tool can be used to encourage collaboration. Some lecturers discussed collaboration between students and lecturers with others focussing on how m-learning will enhance collaboration amongst students. Lecturers argued that m-learning encouraged collaboration through the contribution and sharing of ideas on discussion forums. This is an interesting shift from the usual collaboration between the students and instructors based on the traditional approach to teaching and learning in some developing countries. Collaboration amongst students recognises students themselves as being contributors of knowledge. These findings are consistent with the previous research which show that m-learning fosters collaboration and that collaboration improved understanding (Brown 2005; Crescente and Lee 2011; Ferreira et al. 2013; Parsons, Ryu and Cranshaw 2006).

Student collaboration will probably lead to students retaining information longer and developing teamwork skills.

Lecturers suggested that other students could benefit from following group discussions even if they themselves are not sharing ideas or voicing their opinions. While collaboration between students and instructors can improve the teaching and learning experience, student collaboration is encouraged so that students do not become mere consumers of knowledge; rather, they become active contributors to their own learning process. Student collaboration may possibly encourage students to acquire knowledge for its own sake, beyond curriculum content or examination goals.

Although the benefits of collaboration have been highlighted, it was observed that not all students would be keen on collaboration or benefit from it. One lecturer pointed out that some students would only collaborate if there were sanctions for non-participation. Another lecturer argued that collaboration was not possible in their environment, stating that the situation currently does not allow for it.

Given the heterogeneity of students, collaboration will not appeal to everyone as some students prefer to work alone or do not see the benefits of collaborating with others. For such students, it may be necessary to discuss the importance and benefits of collaboration in shaping and enhancing their learning journey, particularly in improving understanding. Table 4.26 highlights how lecturers perceive m-learning as a tool to enhance collaboration, with the single most striking observation by one lecturer that some students would only participate if there were sanctions for non-participation.

Table 4. 26 Lecturers’ comments on collaboration

Respondents	Comments
Lecturer_1	*“It helps improving communication between students and instructors.”*
Lecturer_6	*“The teacher/lecturer is placed in the background thereby fostering greater interaction between students and learning material and amongst students themselves. The teacher/lecturer plays the role of a moderator, supervisor and guide.”*
Lecturer_7	*“Just like how social media enables people to converse at any given point in time, the same is likely to happen with the use of mobile devices. Not to forget that nowadays, an average person (especially millennial) always have their mobile devices with them everywhere they are.”*
Lecturer_8	*“Students participate where there are sanctions for non-participation, otherwise they don’t like it.”*
Lecturer_11	*“I think so. It brings down the walls of the lecture venues.”*
Lecturer_12	*“It is true, that using mobile devices for learning will allow students and lecturers to collaborate.”*
Lecturer_19	*“Yes this is possible. I already do this with my students.”*
Lecturer_23	*“This [collaboration] is difficult in our environment. Situation does not allow for this.”*
Lecturer_24	*“This is true, collaboration is made possible as students and lecturers can access and share information from wherever they are.”*
Lecturer_26	*“Sharing offers advantages in the sense that other people can always "peep" on your work, leave comments to improve the work or simple to follow progress.”*
Lecturer_28	*“Can enhance collaboration, communication and learning through discussion forums.”*
Lecturer_29	*“Ideas can be communicated as and when they come up instead of waiting for face to face interaction.”*

4.5.7.2 Portability

A special feature of mobile devices is their portability enabling them to be carried around as they are small and lightweight. The portability of mobile technologies is discussed extensively in section 2.8.1.1. Surprisingly, only one of the lecturers discussed portability, commenting that portability allows mobility.

> [Lecturer_10]: *“Portability allows mobility, the smaller the device the easier to move around with it.”*

The portability of mobile devices is crucial to the acceptance and implementation of m-learning as it enables students to access learning materials anywhere anytime. Most of the advantages of m-learning are a result of the portability of mobile devices.

4.5.7.3 Flexibility

The flexibility of m-learning is discussed in section 2.8.1.8. Some lecturers reported that m-learning greatly increased flexibility in learning as it enabled both learners and lecturers to access content at any given time, enabling them to remain up to date. Lecturers pointed out that flexibility meant that learning would no longer be confined to certain buildings on university campuses. One lecturer remarked that the use of cloud computing enabled the integration of documents which could be accessed anywhere anytime. This lecturer added that because there is always access to content, learning becomes continuous without depending on the opening and closing times of traditional learning venues such as the library. It is evident that lecturers in Zimbabwe tertiary institutions value the flexibility of m-learning, since participants can access content in their own time and chosen location. Learning is no longer at a fixed pace; rather, participants learn at their own pace with the option to revisit the learning content when necessary. Table 4.27 presents the various aspects of flexibility that result from adopting m-learning.

Table 4. 27 Lecturers' comments on flexibility

Respondents	Comments
Lecturer_14	*"It seems quite flexible and offers great convenience anywhere."*
Lecturer_19	*"There is a lot of flexibility which allows both learners and lecturers to remain up to date with the knowledge base in their field."*
Lecturer_22	o *"Very flexible."* o *"Someone said that learning is now going into the cloud."* o *"The use of Cloud, Google Drive, Dropbox, OneNote etc. enables integration of documents into a one stop shop. The documents can be accessed anywhere, anytime."* o *"Learning becomes continuous, you do not need to wait for the library doors to open."* o *"Learning can even take place whilst you are traveling by bus or flying."*
Lecturer_23	*"That [flexibility] is the best part of the idea."*
Lecturer_24	*"It is very flexible because a learner is not limited to the confines of the college environment, but can access materials anywhere anytime."*
Lecturer_28	*"This is one of the advantages of mobile devices for reaching and learning. Both students and lecturers can access the material at anytime and anywhere, as long as there have access to the Internet."*
Lecturer_30	*"Very flexible."*

4.5.7.4 Ubiquitous learning

The portability of mobile devices means the device can be carried anywhere, so learning is available to the user in a ubiquitous manner (section 2.8.1.3). Some lecturers suggested that by utilising m-learning, learning (1) becomes continuous, (2) is not influenced by location and time, (3) offers unlimited consultation time with instructors, (4) allows ideas to be communicated as and when they arise. Ubiquitous learning, as discussed by the lecturers, removed the limitations imposed on learning by time and space. The findings align with those ubiquitous learning studies which conceive that mobile technologies are tools that allow learners to access information irrespective of their physical context (Chen, Chang and Wang 2008; Pimmer, Mateescu and Gröhbiel 2016). Ubiquitous learning removes time and place limitations, giving learners the flexibility to acquire knowledge when it is convenient for them. Lecturers in Zimbabwe expressed that m-learning would encourage learning anywhere, anytime as indicated in Table 4.28.

Table 4. 28 Lecturers' comments on ubiquity

Respondents	Comments
Lecturer_11	*"I think so. It brings down the walls of the lecture venues."*
Lecturer_22	○ *"The documents can be accessed anywhere, anytime."* ○ *"Learning becomes continuous, you do not need to wait for the library doors to open."* ○ *"Learning can even take place whilst you are travelling by bus or flying."*
Lecturer_24	*"A learner is not limited to the confines of the college environment, but can access materials anywhere anytime."*
Lecturer_26	○ *"The time and space are no longer limitations."* ○ *"In fact, students and lecturers are now able to access and interact with content during work breaks, at night at home or even when travelling."*
Lecturer_29	○ *"Does not limit consultation to the office and office hours."* ○ *"Ideas can be communicated as and when they come up instead of waiting for face to face interaction."*

4.5.7.5 Convenience

The lecturers in Zimbabwe tertiary institutions appreciate the convenience of m-learning from both the students' and instructors' perspective. Most of the lecturers applauded the convenience of integrating of mobile technology with education based on the portability of mobile devices that allowed for flexibility. A common view among the lecturers was that m-learning allowed for learning to happen at any place at any given time. The ability by both instructors and students to access learning material at any given time at any given location provided there was Internet access was applauded for convenience. Some lecturers commented that this would enable continuous learning and that both instructors and students could engage with content during work breaks, while travelling, or during unexpected free time. Previous studies show that students are interested in m-learning because of its convenience (Alowayr and McCrindle 2017; Cheng 2015; DeWitt, Siraj and Alias 2014; Iqbal and Bhatti 2016; Yeap, Ramayah and Soto-Acosta 2016). A study by Schuck et al. (2013) with community university educators, revealed that convenience is an advantage of m-learning for instructors. Convenience of m-learning benefits both students and instructors.

There was a suggestion that m-learning was convenient in that students could re-wind or fast-forward content to suit their preferences using mobile devices, something they cannot do during a lecture. With audio and video, convenience of m-learning can be heightened as students can also pause, restart, skip or focus carefully on selected content. This enables students to control the pace and direction of their learning – something that cannot be done in the lecture room. One lecturer pointed out that with most institutions having multiple campuses, the flexibility of m-learning enabled lecturers to free up some time as they have to attend conferences in addition to university duties and other time-competing demands off campus. Lecturers' comments relating to convenience are presented in Table 4. 29.

Table 4. 29 Lecturers' comments on convenience

Respondents	Comments
Lecturer_2	*"M-learning is very convenient."*
Lecturer_11	*"I think this [m-learning] is the way to go. Its timeous and convenient"*
Lecturer_14	*"It seems quite flexible and offers great convenience anywhere."*
Lectuer_16	*"This [m-learning] is a very useful and helpful concept."*
Lecturer_17	*"They [learners] have control over where and when they can learn."*
Lecturer_21	*"It [m-learning] brings convenience to both learner and teacher in a number of ways."*
Lectuer_22	o *"Learning becomes continuous, you do not need to wait for the library doors to open."* o *"Learning can even take place whilst you are travelling by bus or flying."*
Lecturer_25	o *"Serves time and money."* o *"It's convenient although it is liable to abuse somehow"*
Lecturer_26	o *"Mobile devices combined with Internet access are so flexible that the time and space are no longer limitations."* o *"In fact, students and lecturers are now able to access and interact with content during work breaks, at night at home or even when travelling."* o *"There is also a need to add the rewind/fast-forward capabilities of such devices and platforms."* o *"In fact, students are now able to "jump" content if they already know it or repeat (rewind) whenever they want and this is a limitation in the classroom (can you rewind your lecturer? No.)"*
Lecturer_27	*"This flexibility is required especially in this era of multiple campus, and taking into consideration that lectures have to go for conferences and other duties outside their universities."*
Lecturer_28	o *"This is one of the advantages of mobile devices for reaching and learning."* o *"Both students and lecturers can access the material at anytime and anywhere, as long as there have access to the Internet."*
Lecturer_29	o *"Does not limit consultation to the office and office hours.* o *"Ideas can be communicated as and when they come up instead of waiting for face to face interaction."*
Lecturer_30	*"This is a very good innovation. Tutorials and videos can be accessed at any time by the learners."*

4.5.7.6 Enhanced Interaction

The lecturers commented on how m-learning improves communication. This finding is consistent with the literature which suggests that mobile devices should affect educational outcomes by facilitating communication and improving communication between learners and instructors (Valk, Rashid and Elder 2010; Gong and Wallace 2012). The use of mobile devices allows for instant and spontaneous communication, which can reduce inhibitions. The enhanced interaction was discussed from three perspectives: general communication, student-to-student communication and student-lecturer communication, which is summarised in Table 4. 30.

Table 4. 30 Summary of enhanced communication

Type of communication improved by m-learning	How m-learning improves communication
General communication	Some lecturers commented on how mobile technologies would generally improve communication. This is communication among learners and communication between lecturers and learners. Enhanced communication would be a result of: ➢ Mobile technologies opening up another channel of communication. ➢ Communication becoming more efficient. ➢ No time lag between communicators, thus creating real time service.
Communication among learners	Some lecturers focussed on using communication features of mobile devices as part of the learning activities. In their discussion some of the comments touched on: ➢ Fostering greater interaction among learners. ➢ Social media groups promoted effective communication with the class. ➢ Communication being enhanced through discussion forums. ➢ Ideas being communicated as and when they come up instead of waiting for face-to-face interactions.
Learner-Lecturer communication	Some lecturers focussed on how m-learning would impact communication between themselves and the learners indicating that: ➢ Lecturers have a better opportunity to monitor students' progress. ➢ Timely feedback. ➢ Communication between learners and lecturers can be stored and the stored threads can be used to refer to historical discussions. ➢ Assignments can be sent easily. ➢ Deadlines can be controlled automatically.

It was observed that there was a downside to the increased interaction. One lecturer pointed out that although there is increased communication it was important that students avoid contacting lecturers at odd times.

> [Lecturer_14]: applauded the increased communication, he/she stated, *"As long as timelines are set as some [students] choose to contact lecturers at odd hours."*

The findings in this study also raise the important question of privacy. One lecturer mentioned the need for set times to avoid communication at odd hours. Sending messages at odd hours may be perceived as encroaching on the lecturer's personal space, thus invading their privacy (Kopáčková 2014). The issue of privacy does not affect lecturers only. A study by Terras and Ramsay (2012) found that students felt obliged to respond to notifications sent to their mobile devices, which was uncomfortable for some students who saw this as an intrusion of their personal space. Although m-learning is applauded for facilitating anytime anywhere learning, it is important to take into consideration the privacy issues both from the students' and lecturers' perspectives. However, the findings in this study echo previous findings that m-learning enhances communication through general communication as well as the student-student communication and the student-teacher communication and that students discuss assignments and collaborate with classmates on course assignment projects using mobile technologies (Cheong et al. 2017; Cheon et al. 2012). It may be concluded that while m-learning improves communication, it is not without its downside. It is apparent from the comments presented in Table 4. 31 that lecturers in Zimbabwe would be keen to embrace m-learning because of the increased interaction it provides.

Table 4. 31 Lecturers' comments on enhanced interaction

Respondents	**Comments**
Lecturer_1	*"It helps in improving communication between students and instructors."*
Lecturer_5	○ *"Yes, this create real time service as there is no time lag between the two communicators."*
Lecturer_6	○ *"The teacher/lecturer is placed in the background thereby fostering greater interaction between students and learning material and amongst students themselves."* ○ *"It will modernise lecturer-learner interactions."*
Lecturer_9	*"One additional communication channel."*
Lecturer_13	○ *"This allows for timeous feedback."* ○ *"Gives the lecturer opportunity to monitor progress of the students."*
Lecturer_14	○ *"Use of social media groups offers effective communication with the class."* ○ *"As long as timeline are set as some choose to contact lecturers at odd hours."*
Lecturer_22	○ *"Assignments can also be sent easily."* ○ *"Communication becomes efficient"* ○ *"deadlines can also be controlled automatically"*
Lecturer_28	*"Can enhance collaboration, communication and learning through discussion forums."*
Lecturer_29	○ *"Does not limit consultation to the office and office hours."* ○ *"Ideas can be communicated as and when they come up instead of waiting for face to face interaction."* ○ *"Communication between student and teacher can be stored as threads to allow them to refer to historical discussion"*

4.5.8 Theme 3: Lecturers' expectations

Lecturers in Zimbabwe have different expectations regarding the m-learning mode. The expectations include perceived benefits of m-learning, whether m-learning will be accepted, and concerns about policy.

4.5.8.1 M-learning potential in Zimbabwe

M-learning success at tertiary institutions depends on the active participation of both the students and the teaching staff. It is therefore mandatory that teaching staff accept the m-learning system for it to be a success. Lecturers were asked their opinions on the use of m-learning to gauge their acceptance of it. A number of the lecturers in Zimbabwe expressed that mobile devices have a lot of potential in teaching and learning in this country. The reasons given are presented in Table 4.32.

Table 4. 32 Summary of m-learning in Zimbabwe

(1) Already most people have access to mobile devices. This finding is consistent with literature (section 2.8.1.2). However, (Khan et al. 2015; Osang, Ngole and Tsuma 2013) argue that although many people have access to mobile devices because of the considerable mobile phone penetration, mobile devices are under-utilised for learning. If mobile technologies are not perceived as learning tools, even if there is high penetration of mobile devices, m-learning might not necessarily be accepted. It important that stakeholders appreciate the impact that mobile devices can have on teaching and learning.
(2) Already most students tend to use mobile devices to access content rather than laptops and computers. This finding seems to contradict the technical limitations posed by mobile devices that would discourage learners from using mobile devices in their learning as discussed in section 2.11.2. The preference of mobile devices to laptops and computers may be related to the portability of mobile devices and that the new generation of mobile device users have adapted to using the smaller mobile devices despite the technical limitations.
(3) The trend is already leaning to use of mobile devices for teaching and learning. There is already an expectation of incorporating mobile technologies in teaching and learning. Although there is still a lack of research on m-learning in developing countries compared to developed countries, there is an increase in the level of acceptance and adoption of mobile technologies in teaching and learning in developing countries (Alkhalifah, de Vries and Rampersad 2017; Lamptey and Boateng 2017).

Table 4.33 presents lecturers' comments on the potential of m-learning. Of great interest is one lecturer's comment that Zimbabwe has not yet accepted qualifications obtained on-line. Although online programs may be effective, in some sectors traditional degrees obtained via face-to-face learning may be preferable. Some people did not like the online degrees because

of the reality of online interaction between students and among students (Sadik 2016). Online interaction among learners and between instructors and learners is also a reality of m-learning. An implication of this is that it is highly likely that people who may not accept online degrees based on the online interaction would struggle to embrace m-learning. There may be a need to pay attention to and address these fears and concerns as m-learning demands new ways of learning that are different from the traditional approach.

Table 4. 33 Lecturers' comments on m-learning potential

Respondents	Comments
Lecturer_4	*"There is huge potential especially where there is access to high speed Internet facilities and where there is discipline on the use of the devices."*
Lecturer_5	*"Very possible. Indications are for that direction in near future."*
Lecturer_11	*"I think it's expected that such devices be incorporated into mainstream teaching and learning."*
Lecturer_15	*"It is capable but Zimbabwe has not yet accepted much even on-line degrees."*
Lecturer_26	o *"There is great potential. There is need to acknowledge that the current trend leans more on mobile than laptops and desktops."* o *"It has become normal for students to access and interact with content using mobile devices even when the teacher expects them to use laptops/desktops."* o *"Therefore, there is need to tap into this potential in the teaching/learning process. One of the ways to do this is through micro-learning."*
Lecturer_30	*"Highly capable given that most people own mobile devices."*

4.5.8.2 M-learning acceptance

A minority of the lecturers mentioned that they would not be keen to teach using the m-learning mode for part of their course if offered. The lecturers who were not interested in using the m-learning mode gave as reasons the lack of resources and subject-specific limitations of m-learning.

> [Lecturer_10]: *"Mobile devices do not support compilers for programming languages and cannot handle large databases."*
>
> [Lecturer_14]: *"Erratic access to data makes it a big inconvenience."*
>
> [Lecturer_21]: *"Lack of resources."*

Lecturers who are keen on adopting m-learning gave various reasons for their interest in using m-learning if it were offered as a teaching mode for part of their course/unit. Some lecturers stated that they would be interested in using m-learning because this mode would benefit the learners. The lecturers commented that m-learning would benefit learners because:

(1) Already most learners had the mobile devices (section 4.5.8.1).

(2) Students easily get engaged when using mobile technologies (section 2.8.1.6).

(3) Learners can access content regardless of their location. A key feature of m-learning is its flexibility as previously discussed in (section 2.8.1.8) and (section 4.4.5.2).

(4) Easy access for learners.

These findings corroborate (Annan, Ofori-Dwumfuo and Falch 2018; Oyelere and Suhonen 2016) who claim that mobile technologies enable learners to have access to various educational resources all the time.

(5) Lecturers can engage with learners in a relevant and contemporary manner.

(6) Students enjoy this [using mobile devices for learning], so learning would be interesting. The findings in this study are consistent with the literature, since previous studies show that students enjoyed using mobile technologies for learning and that these devices made learning interesting (Peña-Ayala and Cárdenas 2016; Mahazir et al. 2013).

[Lecturer_22]: *"Since the use of mobile gadgets has become fashionable, the students work and interact with them on daily basis thus making learning and interesting game. Studying and playing are combined and they no longer interrupt each other."*

It gives learners an opportunity for self-directed learning. This study supports evidence from previous studies demonstrating that m-learning encourages self-directed learning (Pachler, Bachmair and Cook 2010; Mahazir et al. 2013). Self-directed learning using mobile technologies depended on the students' individual differences (Karimi 2016). Karimi (2016) expounds on this stating that: (1) Learners who are keen to try new technologies and those who rely on information from others to solve problems were likely to use the m-learning platform in an informal context (2) Learners who rely on their own logical thinking are more inclined to use m-learning in a formal context.

(7) Some lecturers were keen on utilising mobile learning to keep pace with technology. One lecturer considered that embracing m-learning would be moving with technology; similarly, another lecturer was interested in m-learning because of its exploitation of modern technology. This is consistent with the study conducted by Ng and Nicholas (2013), in which 48% of the teachers wanted to keep up to date with new technology.

(8) Other lecturers' interest in embracing m-learning stemmed from the way that m-learning would affect teaching. A summary of lecturers' reasons for wanting to embrace m-learning based on m-learning's impact on teaching is given in Figure 4.18.

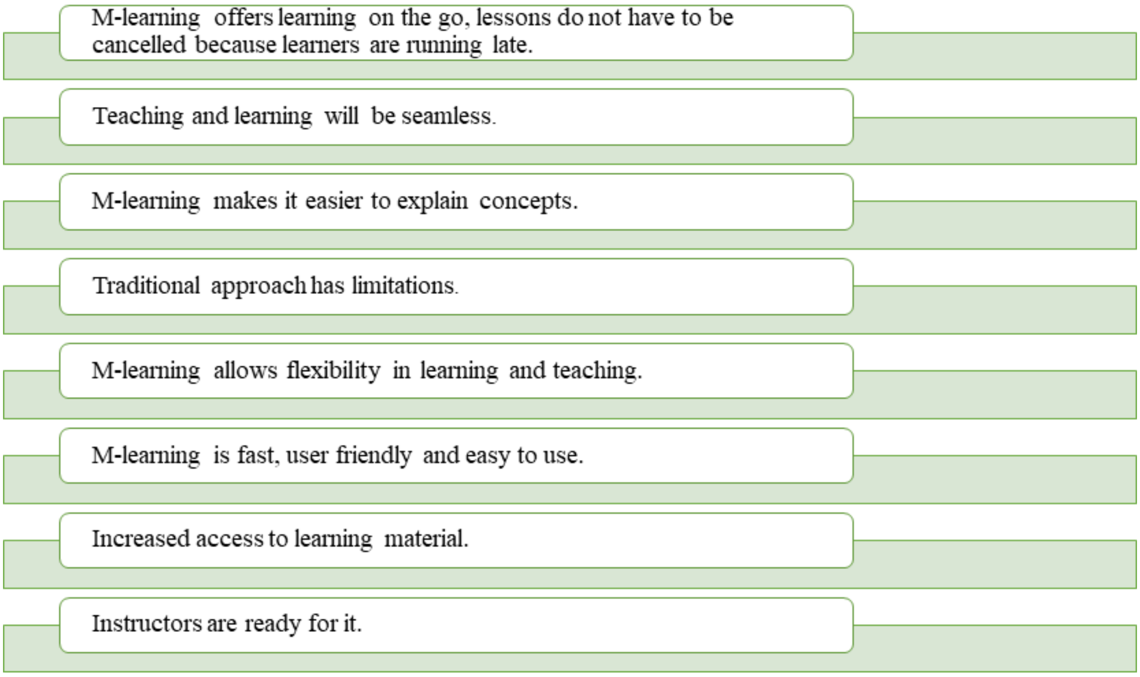


Figure 4. 18 Impacts of m-learning on teaching

4.5.8.3 Conditional acceptance of m-learning

Some lectures, while demonstrating an interest in m-learning, expressed some conditions that needed to be met for them to accept using m-learning mode. The lecturers stated that they would accept m-learning provided that:

(1) There is adequate technical support and necessary hardware.

Technical support includes improved infrastructure and adequate technical assistance with mobile technology (Ng and Nicholas 2013). Handal, MacNish, and Petocz (2013) reported that in Australia, technical support teams in m-learning environments were under immense pressure to make themselves available to both students and staff. A study by Munguatosha, Muyinda, and Lubega (2011) noted that a lack of technical support and infrastructure were key challenges to the adoption of new learning media. The findings of this study confirm that m-learning adoption depends on adequate technical support and infrastructure.

(2) There are no interruptions to connectivity. Poor Internet connectivity as an obstacle to m-learning is discussed in section 2.9.1.2. This finding has important implications for the development of a model for m-learning in Zimbabwe tertiary institutions. With poor Internet connectivity, neither the students nor teaching staff will be keen to adopt m-learning.

(3) It is legalised. There are concerns from one lecturer concerning the legality of using m-learning in Zimbabwe tertiary institutions. While m-learning is innovative and its benefits are acknowledged in the literature, if it is illegal to utilise it, instructors will not be eager to embrace it. Although this finding is quite preliminary, it suggests that some lecturers may be avoiding m-learning on legal grounds.

(4) Training is provided. The importance of training for successful m-learning implementation is explored in section 2.8.1.12. Without adequate training, it may be very difficult to fully utilise mobile technologies for teaching and learning. Table 4. 34 is quite revealing in several ways. For some lecturers, m-learning is about moving with technology; for others, it is about how it would improve student engagement; for yet others, it would improve how they teach, and for some lecturers it has to do with the sustainability of m-learning.

Table 4. 34 Lecturers' reasons for embracing m-learning

Respondents	Comments
Lecture_4	*"Yes. Allows courses to be offered no matter where the student is located, sometimes lectures are called off if students fail to reach the lecture room in time."*
Lecturer_5	*"Yes. Moving with technology."*
Lecturer_6	*"I would. It makes teaching and learning seamless, cutting across space and time. It is learning on the go! It would be fun I think."*
Lecturer_7	○ *"Yes. I have realised students easily get engaged once such devices are being used."* ○ *"It also makes it easier to explain concept."*
Lecturer_8	*"Provided adequate support technically is availed and also provision of the necessary hardware."*
Lecturer_9	*"For easy access by students."*
Lecturer_11	○ *"Yes. It allows me to engage with the younger generations in more relevant and contemporary means."* ○ *"The traditional means of teaching and learning have their limitations."*
Lecturer_13	*"Yes, I would be interested because of its exploitation of modern technology."*
Lecturer_15	*"I would be interested because I would be able to teach at any time that is convenient to me and anywhere."*
Lecturer_16	*"Yes, due to its flexibility and ease of use once participants have been equipped with the requisite skills."*
Lecturer_17	*"Yes, increases access."*
Lecturer_18	○ *"Yes, I would be interested provided there is no interruptions on connectivity and as long as the learners can access the information."* ○ *"The advantage is to do with wider geographical coverage."*
Lecturer_20	*"I will be interested yes but only after it's legalized."*
Lecturer_22	*"Yes. Mobile learning is fast and friendly. The students also enjoy it so learning becomes interesting for all."*

Lecturer_23	○ *"Yes, I would be interested. Mostly because of the subject area that I teach."* ○ *"I like mobile devices' ability to teach students at any time and at their pace."*
Lecturer_24	*"Yes, most students have the devices, I am ready, and so it will be interesting."*
Lecturer_25	*"If I get the training, yes."*
Lecturer_26	*"I would be happy to teach in that course. The reason being that I have realized the potential for mobile devices for educational purposes. For example, why forcing a student to consult the definition of Sociology from a library traditional book when it is possible to find the same content on YouTube explained by the best professionals in the work in a much easier way to understand?"*
Lecturer_27	*"Yes, it allows teaching to take place even if you are away from work."*
Lecturer_28	*"Yes, I would be interested, because the material would be much more broadly available."*
Lecturer_29	*"Yes. It affords the students an opportunity to have self-directed learning."*

A summary of what lecturers would require in order to accept m-learning is presented in Figure 4.19.

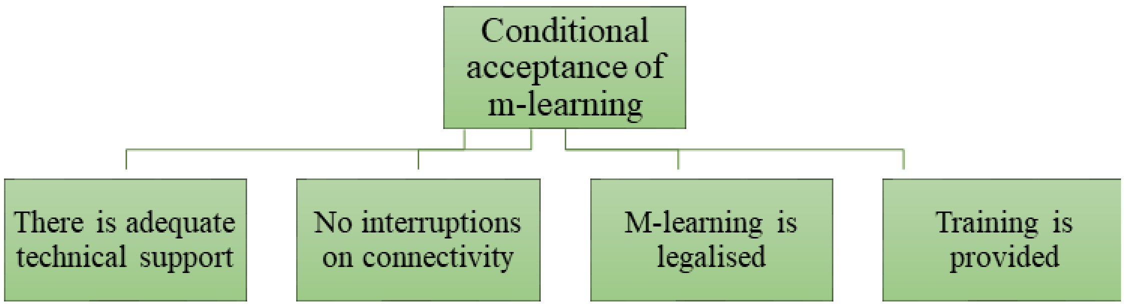


Figure 4. 19 Summary of what lecturers would require in order to embrace m-learning

4.5.8.4 Not so keen on m-learning

A small number of the lecturers indicated that they were not keen to embrace m-learning currently. The reasons for lack of interest were course/unit-specific. These findings particularly for Computer Science support previous research which suggests that programming on mobile devices, while possible, would require specific mobile devices and more work to improve execution performance (Asabere 2013; Tillmann et al. 2011; Liang, Li and Chen 2014). With m-learning still in its infancy in Zimbabwe, specialised subjects such as programming may not readily benefit from m-learning. However, there is still an opportunity to tap into other characteristics of m-learning such as collaboration, increased access to resources and enhanced communication. Comments from lecturers not so keen on m-learning are presented in Table 4. 35.

Table 4. 35 Lecturers' reason for their reluctance to accept m-learning

Respondents	Comments
Lecture_10	*"Mobile devices do not support compliers for programming languages and cannot handle large databases."*
Lecturer_11	*"My field is more practical, but there is room for the use of mobile devices in classroom learning."*
Lecturer_12	*"Some things in medicine and nursing need face to face contact."*
Lecturer_14	*"Erratic access to data makes it a big inconvenience."*
Lecturer_15	*"Mobile learning is easy and good for those disciplines that are non-calculative. Difficult to adopt in calculative disciplines."*
Lecturer_18	*"It [m-learning] is possible and a useful strategy for some modules but not all of them."*
Lecturer_24	*"In my discipline, Computer Science, mobile learning can be adopted in most of the courses although it needs to be blended in some courses that are practical in nature like programming."*

4.5.8.5 Policy change

Lack of appropriate policy as a barrier to m-learning implementation is discussed in section 2.9.3. A minority of the lecturers discussed policy. There were calls for amendment of the policy and one lecturer reported that current policy at their institution was unfair. The lecturer who complained about this discussed the Bring your Own Device (BYOD) policy. The lecturer would have preferred to be provided with a device by the institution. If institutions can provide Internet access, they may still be a need to give students access to computers. Ng'ambi et al. (2016) in their study of technology-enhanced teaching in South Africa, assert that while institutions in South Africa give Wi-Fi access to support BYOD the provision of access to traditional computers in the computer laboratories remains, as not all students can afford suitable mobile devices. Traxler (2013) mentions a number of successful BYOD m-learning projects such as MOBIlearn and Digital Reading Room and various other BYOD initiatives at various universities. The success of the BYOD projects, which shift the cost of devices to students, relies heavily on the availability of the devices, which can be a huge problem for students even in some wealthier regions like New Zealand and the USA (Traxler 2013). The issue of BYOD is an equity issue for students and continues to raise debate on the BYOD strategies. While on one hand it transfers the cost of devices to students (making it free of cost), it does not cater for low-income students. The merits and demerits of BYOD strategies may continue because not everyone can afford a device. In this particular study lecturers have reported that not all students have access to mobile technologies. A BYOD policy in unequal contexts of tertiary institutions in Zimbabwe would greatly disadvantage students who cannot afford the mobile technologies.

Lecturers have suggested that changes be made to policy to incorporate the use of mobile devices in teaching and learning. One lecturer recommended that change in policy is fundamental and should be addressed first before professional development. One lecturer stated that there is need for policy in the institutions that can guide portable device usage in the tertiary institutions. Another lecturer recommended a change in policy and mindsets regarding m-learning. The findings in this study confirm the findings of Chitiyo and Harmon (2009) who asserted that there is a dearth of policy governing ICT use in tertiary institutions in Zimbabwe.

M-learning policy should be well-thought-out and the policymakers should have a comprehensive knowledge of m-learning so that the policy is appropriate for the specific context and can successfully guide m-learning implementation and adoption. The findings of this study are helpful to policymakers, as they increase the awareness of the advantages that mobile devices offer to teaching and learning. In countries like Zimbabwe where m-learning is in its infancy, when policy makers acknowledge the importance of m-learning this can then be translated to strategy. Table 4.36 shows several comments on policy. What is evident in Table 4. 36 seems to be a lack of clear policy or an outdated policy regarding integration of technology with education.

Table 4. 36 Lecturers' comments on policy change

Respondents	Comments
Lecturer_8	*"At our institution they have a very unfair policy that lecturers should bring their own devices (BOYD) for use in lectures."*
Lecturer_15	*"There is need for policy changes and mind set [regarding m-learning]".*
Lecturer_20	*"I think amendment of the Education Act to incorporate first then a staff development for teachers and support staff on the its modalities"*
Lecturer_26	*"Institutional policy in place to guide portable devices usage."*

4.5.9 Theme 4: Current use of mobile devices in teaching and learning

Lecturers reported that they do utilise mobile devices for teaching and learning to some extent. Instructors generally use mobile technologies to: (1) support students' learning activities and (2) actively engage with learners in class.

4.5.9.1 Supporting learning activities

Most lecturers use mobile technologies to deliver different learning content to students, with some learners also using their mobile devices to access this content. Currently, mobile devices are being used in various degrees for teaching and learning, but centred on content dissemination, communication, and assigning tasks to students. These findings are similar to those of earlier studies showing that mobile devices support learning activities by enabling learners to access learning content and offering course support (Yousafzai et al. 2016; Lakshminarayanan, Ramalingam and Shaik 2015). Table 4.37 shows some of the supporting learning activities conducted by lecturers using mobile devices.

Table 4. 37 Lecturers' comments on teaching and learning activities for information delivery

Respondents	Comments
Lecturer_3	*"Sharing assignments and notes with students. Making notices regarding our lectures."*
Lecturer_4	*"Share lecture material, look up references."*
Lecturer_5	*"Giving assignments and any communication, presentations by students etc.,"*
Lecturer_12	*"Information sharing, uploading learning material."*
Lecturer_13	*"Giving tasks, disseminating reading material and notes."*
Lecturer_14	*"Look up videos that can give practical examples."*
Lecturer_15	*"Giving students work to do when you are away."*
Lecturer_16	*"Provide lecture and assignment material."*
Lecturer_17	*"Assessment, presentations."* *"Upload course outlines, lecture notes and reading materials."*
Lecturer_20	*"Receive and send lecture notes."*
Lecturer_21	*"Giving notes and assignments."*
Lecturer_22	*"Discussion groups, videos for explaining concepts, pictures, diagrams and even demonstrations. YouTube videos can be sent to students via WhatsApp, Facebook, blackboard etc."*
Lecturer_23	*"Distribution of content."*
Lecturer_24	*"Sending and viewing lecturer notes, tools for notifications and general communication."*
Lecturer_25	*"Sharing information through WhatsApp groups with students."*
Lecturer_26	*"It is possible to crowdsource pictures of insects in biology/agriculture classes and create a fairly good repository of images for class activities."*
Lecturer_28	*"Assignments and lecture material."*
Lecturer_30	*"Sending notes."*

4.5.9.2 Actively engage with learners in class

Some lecturers reported that they use mobile devices to engage with the students; they use mobile devices for question-and-answer chats in class groups. It is apparent from Table 4.38 that few lecturers currently use mobile devices to engage with learners during classes. It seems that in Zimbabwe universities, mobile technologies are used mainly to disseminate information.

Table 4. 38 Lecturers' comments on how they use mobile devices to engage students during classes

Respondents	Comments
Lecturer_15	*"Having question and answer chats with learner."*
Lecturer_17	*"Quiz"*
Lecturer_19	o *"Brainstorming and discussions for group tasks."* o *"Remedial discussions with students performing below expected standards."*
Lecturer_24	*"Participation in discussions."*
Lecturer_28	*"Discussions and feedback."*

4.5.10 Theme 5: M-learning challenges

M-learning challenges according to literature have been outlined in section 2.9.

4.5.10.1 Infrastructure

Infrastructural challenges are discussed in section 2.9.1. In Zimbabwe, the lecturers reported poor infrastructure in terms of inconsistent electricity supplies and poor Internet connectivity. Internet connectivity was in some cases linked to the power outages. Some lecturers discussed poor bandwidth, the need for continuous Internet access, and poor network which did not allow simple phone calls, slow or no Internet connection, challenges with Internet connection at university campuses, no Internet access at home. One lecturer thought the Internet infrastructure was above 60% and deemed it adequate. These findings match those of previous studies that mention poor infrastructure as being a key challenge to m-learning adoption and implementation. The findings raise the possibility that while the infrastructure in Zimbabwe could do with some improvement, in some sectors the infrastructure may be adequate for the implementation of m-learning. The main infrastructural challenges to m-learning have to do with unreliable power supplies and Internet connectivity issues as shown in Table 4.39.

Table 4. 39 Lecturers' comments on infrastructural challenges

Respondents	Comments
Lecturer_3	*"[Lack of] availability of powerful Internet connection."*
Lecturer_4	*"Limited Bandwidth."*
Lecturer_6	*"As long as there is an assured constant power supply"*
Lecturer_8	*"Power cuts."*
Lecturer_12	*"Mostly electricity outages (which affect Internet connectivity as well)"*
Lecturer_17	*"Bandwidth"*
Lecturer_18	*"Continuous access to Internet connectivity for both lecturers and students."*
Lecturer_20	*"The network can sometimes be so poor that if one fails to make a simple phone call what [about trying] to conduct a lesson?"*
Lecturer_21	*"Connectivity is a problem sometimes."*
Lecturer_22	*"Besides connectivity issues, mobile devices are very useful."*
Lecturer_23	*"Another constraint is power."*
Lecturer_25	*"Lack of Internet access could be a major problem."*
Lecturer_27	*"Supporting infrastructure."*
Lecturer_28	*"Generally slow connectivity in many places across the country"*
Lecturer_30	*"There is sometimes challenges of Internet on university campuses and there is no internet at home for most students who live off campus."*

4.5.10.2 Device issues

Some lecturers in Zimbabwe reported that a challenge to m-learning was related to the mobile devices. Concerns expressed about the devices included lack of access of mobile devices, the technical constraints of the mobile devices and devices not being suitable for m-learning. Some lecturers reported that not all students would have access to mobile devices because not everyone could afford to have one, raising a concern that m-learning could not be universally applied based on the availability of mobile devices. These findings are similar to the findings by library staff reported in section 4.3.6.4. The issue of devices was not limited to students only; some lecturers want their universities to provide mobile devices for faculty members.

Some of the academic staff discussed the technical constraints of using mobile devices, which made it difficult over long periods of use. These technical constraints such as the limited size and limited memory are explored in section 2.11.2. It may be necessary to advise students on the minimum standard of the mobile devices that can be used for m-learning; however, affordability still remains an important factor.

Some lecturers pointed out that students did not have suitable mobile devices. Students owned defective devices, devices that are not relevant and devices that are not compatible with modern technology. Some lecturers suggested that devices should be user friendly, affordable and compatible with the virtual environment. Another comment pointed out the need for familiarity with available devices in the Zimbabwe social and economic environment. This study shows that even if most people have mobile devices in Zimbabwe, some of these devices may not be appropriate for m-learning. While unsuitable devices could be an obstacle to m-learning in Zimbabwe this might not be an issue in countries where m-learning has since taken off. The findings raise intriguing questions regarding the mobile devices in Zimbabwe given the current socio-economic challenges, which begs the question of whether learners have the financial means to purchase appropriate and compatible devices or whether the government can subsidise the cost of the devices as suggested by some of the lecturers. It is clear that there are concerns regarding the use of mobile devices for teaching and learning as shown in Table 4.40. The concerns regarding mobile devices include availability, suitably, affordability and technological constraints of the devices.

Table 4. 40 Lecturers' comments on device issues

Respondent	Quotation
Lecturer_1	*"Training in specialised apps, for m-learning"*
Lecturer_3	*"Accessibility of user friendly devices."*
Lecturer_4	*"Getting the appropriate devices that are compatible with virtual environment."*
Lecturer_5	o *"Availability of mobile phone may also be a challenge since students come from different backgrounds and have different resources endowments."* o *"Having/owning the gadgets, being able to use it for its intended purpose."*
Lecturer_8	o *"At our institution they have a very unfair policy that lecturers should bring their own devices (BOYD) for use in lectures."* o *"Defective devices."*
Lecturer_9	o *"Some documents cannot be downloaded on mobile device."* o *"The change in delivery must involve the right type of mobile device for learners and teachers at subsidized rate."*
Lecturer_12	o *"Some things in medicine and nursing need face to face contact"*
Lecturer_15	*"Some mobile devices are not compatible with modern technology."* *"Mobile learning is easy and good to those discipline that are non-calculative. Difficult to adopt in calculative disciplines."*
Lecturer_16	o *"No such devices and the requisite training have been provided to lecturers and students."* o *"Affordable gadgets are required."*
Lecturer_17	*"Range of available technologies."*
Lecturer_18	*"The major constraints may have to do with access to the devices by students mainly."*
Lecturer_19	o *"There is need to be familiar with devices that are available in our particular social and economic environment."* o *"Some learners do not have the relevant device."*
Lecturer_23	*"Not everyone owns the [mobile] device"*
Lecturer_24	*"Limited memory and screen size"*
Lecturer_26	*"Users are unable to spend long periods using small devices since the content is also displayed in small sizes."*
Lecturer_27	o *"Currently universities in Zimbabwe do not provide mobile devices.* o *"Most mobile devices are personal."*
Lecturer_28	*"Relatively high cost of mobile devices."*
Lecturer_30	o *"May not be universally applied since some students cannot afford to own mobile devices."* o *"Universities are not providing laptops for lectures they may not provide these devices as well."*

4.5.10.3 Teaching and learning issues

Various teaching and learning issues were raised by the teaching staff in Zimbabwe tertiary institutions in relation to m-learning. A variety of opinions were expressed which covered affordability, technical and academic issues. Concerns regarding the affordability of mobile devices for students were common, with one lecturer reporting that using m-learning would mean lecturers incurred costs as they would have to foot the bill for data themselves. One lecturer noted that some students would have mobile devices but not a relevant one. A possible reason for this is that these students cannot afford to upgrade their mobile devices to more relevant ones. If some students are unable to afford mobile devices, they would not benefit from m-learning, furthermore the lecturer is therefore unable to universally teach using this mode as some students will be disadvantaged. In an effort to be fair to the students who cannot afford these devices, it is very likely that teaching and learning would continue using the traditional approach. As stated earlier, some lecturers complained that they had to provide their own devices and that some institutions did not provide laptops for them. It is highly unlikely that these lecturers would embrace m-learning given the costs associated with purchasing devices coupled with the cost of data.

A number of technical issues were raised by lecturers who saw them as obstacles to using mobile devices for teaching and learning. The issues ranged from lack of connectors to connect to projectors, technical staff not willing to provide the necessary technical support, the ability to protect content from unauthorised editing and deleting, and understanding of frameworks used to create content. Technical issues that could impact teaching and learning included inadequate technical support, lack of technical knowledge to produce content for mobile devices, and mobile devices not suitable for all content. One lecturer protested that in his institution the technical staff were not readily available to help when required but only availed themselves of advice from more senior teaching staff members. This finding corroborates those in previous studies (Munguatosha, Muyinda and Lubega 2011; Handal, MacNish and Petocz 2013) that discuss the importance of having efficient technical support when implementing m-learning. Lack of technical support is a major obstacle to m-learning implementation and adoption.

Another technical issue that was raised was that not all educators are able to generate content to disseminate via mobile devices. This is consistent with the study by Annan, Ofori-Dwumfuo, and Falch (2018) which showed that in a pilot project that introduced m-learning in tertiary institutions in Ghana, some instructors were not familiar with developing teaching content using computers. This problem was solved by training instructors on how to develop content for m-learning using Learning Mobile Author, after which the instructors were able to upload to the m-learning platform. Dirin and Nieminen (2014) also assert the need for teacher support in creating appropriate content for mobile applications. It is anticipated that with adequate training instructors who cannot develop teaching content using technology, will become competent content developers using computers.

Lecturers in Zimbabwe identified a number of academic concerns. The issues were wide-ranging covering lack of discipline, plagiarism, distraction from academic activities and the view that mobile devices are incompatible with traditional teaching methods. Some lecturers raised concerns about the lack of discipline when students use mobile devices, particularly if they are being used inappropriately in class. Another lecturer echoed similar sentiments stating that some students would misuse the opportunity, which does not contribute to their effective learning. There was common concern over learners diverting to non-academic applications.

> [Lecturer_1]: *"There would be distractions from other apps e.g. WhatsApp"*

Some lecturers reported that both learners and lecturers could be distracted by social media which would disturb the learning and teaching process. In line with social media, one lecturer pointed out that mobile devices were mostly used for social networking.

> [Lecturer_20]: *"Mobile services have not been promoted for use in educational activities but only for communication and money transfer."*

This presents a challenge in that some people may not perceive mobile devices as educational tools, but rather as communication tools. This corroborates earlier findings that suggest that some students do not perceive mobile devices as educational tools but as entertainment and communication tools (Maketo and Balakrishna 2015; Sey 2011). In such cases, there is need to change the users' mindsets so that they perceive mobile tools as a means of communicating as well as learning. Lecturers in this study also commented on students' perceptions that mobile technologies are for non-academic purposes. Concerns were raised that both students and lecturers can be distracted by social media. Another lecturer confirmed that some colleagues do not perceive mobile devices as learning tools.

> [Lecturer_26]: *"Perceptions from teachers/educators/faculty heads that mobile devices constitute distractions rather than educational tools"*

While discipline should be encouraged to ensure learners and instructors use mobile devices appropriately for teaching and learning, another school of thought encourages the incorporation of social media apps and social networking in teaching and learning.

Surprisingly, only one lecturer discussed the problem of plagiarism. This lecturer pointed out that plagiarism is rife among students who use mobile devices. The lecturer suggested that necessary guidelines should be provided, so that the benefits of m-learning are not eroded by the disadvantages of plagiarism. The problem of plagiarism was also reported by Gong and Wallace (2012), who stated that plagiarism continues to be a challenge regarding m-learning and should be monitored for longitudinal trends. Plagiarism not only affects the quality of learning, but can have dire academic consequences for students.

One lecturer reported that some instructors were familiar with traditional approaches to teaching that did not promote the use of mobile devices. This finding is consistent with earlier research that suggested that instructors need to change their teaching approaches and teaching roles when learning is mediated by technology (Fleischer 2012; Asiimwe, Grönlund and Hatakka 2017). The findings of the study imply that some lecturers may be aware of the changes they need to make, but do not know how to implement the changes or that they may altogether not like the associated changes that come with technology-mediated teaching and learning. Training would go a long way towards mitigating this problem.

A minority of the lecturers reported that they would not use m-learning if it was offered in their course or unit. The reasons given for their lack of interest was the paucity of resources which included poor Internet connectivity and that m-learning was not suitable for their specific course/unit. A study by Jung (2015) revealed that some teachers of English as a Foreign Language found m-learning to be useful because it provided them with a wireless networked learning environment, which increased the possibility of accessing learning content. If the Internet connectivity is poor, m-learning can provide little or no benefit which could possibly explain the reluctance by some Zimbabwean lecturers to use m-learning if the resources are not adequate. Some lecturers felt that the acceptance of m-learning by the general population would be a challenge.

> [Lecturer_16]: *"On paper a good idea."*

This seems to imply that in theory the concept of m-learning is good; however, in practice it may not be so good. It is also suggested that m-learning may be met with some negativity.

> [Lecturer_18]: *"The institutions will have to ensure that there is awareness raising on the strategy for buy in by both teachers and learners."*
>
> [Lecturer_20]: *"I will be interested yes but only after it's legalised."*
>
> [Lecturer_26]: *"Mobile learning is a trend but there is need to acknowledge also that there is a section of the population not yet used to the technology or not yet having the proper mindset."*

These findings suggest that some of the lecturers may have an unfounded negative view of m-learning. In such cases, it may be necessary to create awareness. While the lecturers interviewed for this study have positive attitudes to m-learning, it is important to consider the reasons for any reluctance to embrace m-learning, particularly where the reasons relate to fundamental issues that may hinder m-learning adoption and implementation. It was suggested that in order for m-learning to succeed, support and commitment from government and institutions were necessary. One lecturer complained that in Public Administration course at his university, most of the students are from government-related agencies which do not favour such learning methods. This lecturer suggested there be promotional campaigns for this mode of delivery. These findings confirm the need for institutional support when implementing m-learning (Ismail, Azizan and Azman 2013; Iqbal and Bhatti 2016). The implication of these findings is that there is a need to obtain support from the m-learning stakeholders. Although students and lecturers will be the main users of m-learning there are still some stakeholders who are pivotal to the success or failure of m-learning adoption, such as the government and tertiary administrators.

One lecturer complained that time was a constraint for using m-learning for teaching. A possible explanation may be that this particular lecturer has considered that teaching and learning using the m-learning mode would require a change in the teaching method and effort would be required to make the content suitable for mobile technology (Fleischer 2012) which would require some time. Given that most lecturers already have full workloads, it may be the case that this particular lecturer would not want to add more work to his/her current workload.

Table 4.41 presents several learning and teaching issues that can result from m-learning implementation and adoption.

Table 4. 41 Lecturers' comments on teaching and learning issues

Respondents	Comments
Lecturer_1	*"Distractions from other apps e.g. WhatsApp"*
Lecturer_3	*"These are expenses. The lecturer has to foot the bill himself/herself."*
Lecturer_4	*"Indiscipline in the use of the devices by students."*
Lecturer_5	o *"Students may divert to other uses e.g. WhatsApp."* o *"Availability of mobile phone may also be a challenge since students come from different backgrounds and have different resources endowments."*
Lecturer_7	*"Given what our students have been exposed to through mobile devices, chances are high they may easily switch to other applications thus affecting what is to be learn at that particular time."*
Lecturer_8	*"Technical staff is generally reluctant to provide assistance, they are just keen to help senior people to keep their jobs."*
Lecturer_11	o *"Plagiarism is still a concern and when such devices are available,"* o *"Plagiarism is rife amongst students and without such guidelines, the benefits will easily be eroded by the disadvantages."* o *"Some students would misuse the opportunity, which does not contribute to their effective learning."*
Lecturer_13	o *"Used to teaching methods that do not promote mobile devices."* o *"Mobile devices mostly used for social networking."*
Lecturer_14	o *"There seem to be too many distractions such that the students and also the teacher can get carried away and lose attention."* o *"Some [learners] choose to contact lecturers at odd hours."* o *"It [m-learning] may be met with unnecessary negativity."*

Lecturer_17	o *"Time is a constraint for using mobile devices for teaching and learning."* o *"However, there is still some concerns that social media which has taken many sectors including the higher education by storm may distract teaching and learning"*
Lecturer_19	*"Some learners do not have the relevant devices."*
Lecturer_20	o *"I will be interested yes but only after it's [in m-learning] legalized* o *"The acceptability by the generality could be a challenge"*
Lecturer_23	*"Not all educators are able to generate content to distribute with the mobile devices."*
Lecturer_26	o *"Difficult to create content that requires typing"* o *"Perceptions from teachers/educators/administrators that mobile devices constitute distractions rather than tools."*
Lecturer_29	*"Usability for reading e.g. using a smartphone to read a pdf document."*
Lecturer_30	*"Large students' numbers may congest the teachers' mobile device since there will be a lot of activity on the device."*

4.5.10.4 Training

Lecturers agreed that there was need for the training of both lecturers and learners prior to implementing m-learning. The lecturers seek various types of training which range from basic induction to more specific training. The training needs were predominantly operational with some lecturers recommending training that addresses the pedagogical aspects of m-learning. Table 4.42 highlights the training needs of lecturers and students according to lecturers.

Table 4. 42 Summary of training needs according to lecturers

Pedagogical aspects of training Professional development on why the m-learning mode of delivery should be considered. ➢ Training that looks into the potentials of using mobile technologies in teaching and learning. ➢ Training on modalities of m-learning. ➢ Training on the need to embrace mobile devices in teaching and learning. ➢ Training on how to maximise the use of mobile technologies in teaching and learning. ➢ Training on specific ways/tools/pedagogy for mobile technologies.
Operational aspects of training **Training for lecturers** ➢ Induction or familiarisation with relevant applications. ➢ Training on how to effectively use mobile technologies for teaching and learning. ➢ Training for lecturers to change their attitudes towards mobile technologies. ➢ Training on how to use online platforms. ➢ Training on how to produce m-learning content and teaching tools. ➢ Training on how to use devices, installations of applications, linking devices to institutional servers or databases. ➢ Training in the use of different platforms to create content and to host lecture material. ➢ Training of the applications used and how to use them. ➢ Training on Learning Management Systems. ➢ Training on how to create interactive learning forums. ➢ Training on online marking methods, online document submission technology, creating online groups. These findings align with previous studies that suggest the need for basic training in using mobile technologies for teaching and learning (Attewell 2005; Handal, MacNish, and Petocz 2013).
Students' training ➢ Train learners how to use mobile technologies for learning. ➢ Train learners how to access learning material. Practical training for learners, knowledge of applications and how to use these applications. The findings in this study match those observed in previous studies. (Bhuasiri et al. 2012; Attewell 2005; Ng and Nicholas 2013) argue that universities need to focus on increasing technology awareness and providing training to learners to facilitate integration of ICTs in education.

The findings under pedagogical aspects of training are likely to motivate lecturers to embrace m-learning. This is because the training will likely increase their confidence and knowledge of ways to incorporate mobile technologies in teaching and learning appropriately, which will be supported by them knowing the benefits of why m-learning. Table 4.43 presents lecturers' comments on pedagogical aspects of training.

Table 4. 43 Lecturers' comments on pedagogical aspects of training

Respondents	Comments
Lecturer_4	*"Grooming of old age lectures to accept new technologies in the learning environment."*
Lecturer_13	*"Emphasis [of training] placed on its great potential in teaching and learning."*
Lecturer_19	*"How to maximise the use of mobile devices in teaching and learning."*
Lecturer_20	*staff development for teachers and support staff on the its modalities"*
Lecturer_24	*"The need to embrace mobile devices in teaching and learning, their strengths and weaknesses so that they may be used appropriately."*
Lecturer_26	*"As for teachers, that's a divided subject because many are still to acknowledge the educational potential of these devices. Therefore, there is a need to start by helping them understand that potential only then you can train then on specific ways/tools/pedagogy for mobile technologies."*
Lecturer_27	*"Teachers need to be trained in order to change their attitudes."*

There are various aspects of operational training raised by lecturers as shown in Table 4.43 above. It is evident that the levels of mobile literacy in Zimbabwe are not uniform and the confidence in using the m-learning mode of delivery will in turn not be received with the same levels of confidence. It would seem that lecturers in Zimbabwe institutions are trying to find ways of incorporating mobile technologies in teaching and learning but feel they would benefit more from professional development which would improve their mobile literacy and confidence. The findings, while preliminary, suggest that training students to use mobile technologies for learning may be essential though the type and level of training required may differ with the heterogeneous students. This study raises the possibility that: (1) some students do not perceive mobile devices as educational tools (2) some students may require training on using mobile devices for learning and (3) without creating awareness of how to use mobile devices for learning, learners may continue to perceive mobile devices as non-educational tools. Training will enable lecturers and students alike to use mobile devices effectively and efficiently which will likely influence their perceptions of mobile devices as educational tools.

The suggested technical training aspects raised by lecturers are consistent with literature that recommends technical training that is hands-on for effective m-learning (Islam, Beer and Slack 2015; Handal, MacNish and Petocz 2013) who state that in integrating ICT with education, academics require technical training which is practical and hands-on which will enable lecturers to use videos and tutorials effectively. This is also consistent with the study by Handal, MacNish, and Petocz (2013) where academics sought training to identify the most appropriate apps and how to get the best out of them. Academics in Zimbabwe make fair demands for technical training, just as formal training was provided when computers were first introduced it seems reasonable to provide technical training when integrating mobile technologies with education.

For m-learning to be a success, there may be need to start off with an analysis to establish what kind of training will be required and how these training needs will be met. It may be concluded that professional development with m-learning will not be a once-off event but will be a continuous process as technology continues to evolve. The different types of operational training required by lecturers to prepare teaching staff for m-learning are presented in Table 4.44.

Table 4. 44 Lecturers' comments on operational training

Respondents	Comments
Lecturer_3	○ *"Training of the tutors in use of the devices, installations of applications, linking these devices to institutional servers or databases that can be faced with resistance from the management."* ○ *"However, many teaching staff are lagging behind use mobile devices as teaching aids. There is need for training on part of the lecturers."*
Lecturer_5	*"Creating tailor made programmes related to their use in relation to subject content."*
Lecturer_4	*"Use of different platforms to host lecture material through the institution host, and grooming of old age lectures to accept new technologies in the learning environment."*
Lecturer_6	*"I think it will be to do with induction and familiarisation with the relevant application/s."*
Lecturer_10	○ *"There is great need, most are illiterate in terms of using mobile devices for teaching purpose."* ○ *"Awareness and a bit of training."*
Lecturer_12	*"Skill acquisition for contemporary approaches. Most of us are used to the fundamentals only."*
Lecturer_14	○ *"I feel that in general teachers have the basic knowledge and more technical know-how is minimal so maybe development in that area will be a good start."* ○ *"Technical training."*
Lecturer_15	○ *"When using the mobiles devices to that extend, there is need for people to be taught how to use then, just like with the computers."* ○ *"Need to be taught how to access the library and having the techniques on presenting the content."*
Lecturer_16	○ *"No such devices and the requisite training have been provided to lecturers and students."* ○ *"Proficiency in the required software and programmes used."*
Lecturer_17	*"Skills training for instructors."*

Lecturer_18	*"Both lecturers and students need to be introduced and taught on how to use whatever online platforms used by their institutions."*
Lecturer_20	*"[Training on] use of online marking methods, use of online document submission technology, creating online learning groups."*
Lecturer_22	*"E-learning courses such as MOOCS, Blackboard etc. There is also need for continuous engagement with the devices."*
Lecturer_23	*"At our institutions, orientation will be very vital."*
Lecturer_24	*"The relevant software and how to use them, which is not much. It is just an adjustment from desktop computers which learners and instructors already have knowledge of."*
Lecturer_25	*"Training in all aspects. Comprehensive training."*
Lecturer_27	*"Students needs to be taught meaningful use of mobile devices."*
Lecturer_28	o *"Production of mobile learning and teaching tools."* o *"For teaches, training and technical support is required in producing the material, especial video lectures. Students generally need help with accessing the material."*
Lecturer_29	o *"For teachers- the understanding of frameworks/ platforms used to create the content."* o *"What are the legal/intellectual property implications of placing content on such a platform?"* o *"Ability to protect content from unauthorized editing and deleting."* o *"For students-the understanding of frameworks/ platforms used to access the content."*
Lecturer_30	*"How to do use it."*

4.5.10.5 Self-learning

Opinions differed as to whether m-learning improved self-learning. While some lecturers argue that m-learning encouraged self-learning, others felt self-learning would only benefit certain students, while others felt that m-learning would not necessarily translate to self-learning. Some lecturers argued that self-learning would benefit certain students who did not require constant monitoring or supervision. These learners are described as *"self-starters", "self-actualised", "adult-learners", "disciplined", and "focussed"* by the lecturers. One lecturer highlighted that there is a need to train learners to avoid distractions or activities that hinder their learning when using mobile technologies so that they can study independently. This lecturer pointed out that learners should be trained to self-monitor and not have a *"nobody is* *watching"* feeling. The findings in this study align with those of (Wang, Wu and Wang 2009) who claim that self-learning plays a critical role in m-learning acceptance. Mobile devices disrupt conventional approaches to knowledge transfer from teacher to student, thereby leading to self-learning (Attewell 2005; Wang, Wu and Wang 2009). M-learning is likely to benefit students who can independently undertake learning activities. However, all students can be trained to become more autonomous in terms of their learning.

Some lecturers discussed the implications of self-learning for teaching and learning when m-learning is used to deliver course materials. One lecturer reported that the lecturer would make available learning content with feedback going between the lecturer and learner. Another lecturer argued that this was more applicable to adult learning, where the lecturer provides guidance to the learner. This view was echoed by another lecturer who suggested that the role of the lecturer becomes one of moderator/guide who encourages greater interaction among learners. There were suggestions that when the lecturer takes a moderator role, learners engage more with the content. It was suggested that since learners are attached to their mobile devices, if the learning material was available on these devices, learners would take the initiative to learn. Some lecturers argued that m-learning would generally lead to self-learning by: (1) developing independent learners equipped for problem solving; (2) allowing learners to study on their own and at their own time, and (3) empowering the learner and giving the learner control over his/her learning. These findings which indicate that m-learning can lead to self-learning, are consistent with those of Pachler, Bachmair, and Cook (2010), whereby learners using mobile devices organised their learning in a self-directed manner. The implication of these finding are that using m-learning mode learners could foster self-learning. This is opposed to the suggestion made by some lecturers that m-learning would only encourage self-learning for those learners who are already independent and do not require constant supervision.

Some lecturers were a bit cautious about how m-learning would encourage self-learning. It was suggested that self-learning would not work for learners who depend on supervision. Another lecturer argued that students who are used to being provided with everything would struggle. It was recommended that the lecturer still had an important role to supervise the self-study as well as intervene and provide guidance when necessary. Another lecturer argued that for students to appreciate self-learning, they needed to be motivated. One lecturer commented that self-learning depended on how disciplined and focussed the learners are. There was a suggestion that there be measurable key result areas to assess the effectiveness of self-learning. There were concerns that, using mobile technologies, students could ask other learners to answer for them, and it was recommended that there be a mechanism to ensuring that each student was doing his/her own work.

It was suggested that if learners were given appropriate skills to engage with mobile technologies for learning, they could utilise these devices for self-learning. One lecturer was not sure the learners had the discipline for self-learning without some supervision by the lecturer. One lecturer remarked that while m-learning was a good concept, it required a firm culture which was lacking in the students. This lecturer pointed out that learners were driven by the need to earn marks, rather than learning. This may imply that such learners would not really be keen on self-directed learning if they do not like reading; however, it is arguable that such learners, in an effort to earn marks, may actually utilise m-learning to conduct research on what they need to earn them good marks. It is encouraging to compare these findings with those found by Kong and Song (2015) where learners used the BYOD initiative for e-learning. The study proved that e-learning could facilitate self-learning. Aligning with this, Chang, Chiu, and Huang (2018) asserted that m-learning helps students cooperate with others to improve their self-learning and Salam, Makina, and Bakar (2013) declares that self-learning is an advantage of web-based learning. While not all students may not be self-learners, m-learning offers opportunities to enhance self-learning.

The combination of findings indicate that m-learning contributes to self-learning and that students who are more autonomous in their learning may more readily self-direct their own learning. There is also a possibility that some learners may start to improve their self-learning because of m-learning. Interestingly, one lecturer did not think self-learning would be realised by using m-learning at his institution describing it as a *"utopian dream."* Concerns were raised by some lecturers about how most students needed constant guidance and supervision. It is likely that if a lecturer has learners who are used to teacher-centred teaching and learning, self-learning seems unrealistic. If learners are used to teacher-centred learning only, the transition to self-learning should not be expected to be immediate because of the integration of mobile technologies. It is very likely to be gradual. Table 4.45 highlights lecturers' perceptions on self-learning in relation to m-learning. From Table 4.45, it is interesting that some lecturers feel that students are not ready for self-learning. There is need for a change in the mindsets of the learners. There may be need for pedagogical changes as well so that curricula encourage self-learning.

Table 4. 45 Lecturers' comments on self-learning

Respondents	**Comments**
Lecturer_2	*"It works fairly well with self-actualised students, those who depend on supervision it might not work."*
Lecturer_3	*"That's true. Where the lecturer avails the teaching materials on the e-learning platform for students to download the content, send or receive feedback from both ends."*
Lecturer_4	*"It's possible where students are self-starters. Where they are used to being provided with everything the students may initially struggle."*
Lecturer_5	*"This is more applicable in andragogy (adult learning) where the lecturer is there to provide guidance and not to drill as it were in child learning (pedagogy)."*
Lecturer_6	*"That is true, the teacher/lecturer is placed in the background thereby fostering greater interaction between students and learning material and amongst students themselves. The teacher/lecturer plays the role of a moderator, supervisor and guide."*
Lecturer_7	*"Students are more attached to their mobile devices, having learning material with them on those devices may help them take initiative to learn."*
Lecturer_8	○ *"This is a utopian dream!"* ○ *"Its [m-learning] a good concept but it requires a firm reading culture which lacks in our students who are only driven by the need to earn marks rather than learning."*
Lecturer_11	*"Yes and no. We cannot invalidate the role of the teacher in the learning process. Whilst students can enhance how they learn, the teacher still needs to be able to supervise all self-studies that occur."*
Lecturer_12	*"Motives are required to make students appreciate this."*
Lecturer_13	*"Develops an independent learner who is equipped for problem solving."*
Lecturer_14	○ *"It depends on how disciplined and focused the students are."* ○ *"There is need to have measurable key result areas to assess effectiveness."*

Lecturer_15	○ *"Yes, the statement is correct, but when it comes to answering questions on mobile, students may ask others to answer for them."* ○ *"There must be some mechanisms to be sure that it's the student who is responding."*
Lecturer_16	*"Intervention and guidance from lectures still necessary."*
Lecturer_17	*"To an extent yes, but there can still be a lot of interaction online."*
Lecturer_18	*"Agreed. If they are equipped with the appropriate skills to successfully engage with mobile devices for learning purposes."*
Lecturer_20	*"On self-learning and self-study am not sure students will have that discipline to do so completely without some oversight of a teacher/ lecturer"*
Lecturer_23	*"It gives students independence to study on their own and their own time."*
Lecturer_24	*"With the calls for student centred learning, this empowers the learner and gives the learner control over his/her learning."*
Lecturer_26	*"Some research in the areas shows that sometimes there is need to train the student to be able to avoid distractions, loneliness, boredom and the "nobody is watching" feeling. In other words, when properly implemented and advised it can lead to self-study or little supervision need."*

4.5.10.6 Impact on teaching and learning

A common view among the lecturers was that m-learning would have a positive impact on teaching and learning. Some of the key characteristics of m-learning discussed in section 4.4.5 are: ubiquity, flexibility, increased access, blending, collaboration and convenience. This section discusses how m-learning in general is perceived to impact teaching and learning in Zimbabwe universities. Lecturers reported that m-learning required them to be up to date and widely read, and that they need to be on their toes all the time. A possible explanation for this may be that since learners using mobile technologies will have increased access to learning resources, they need to demonstrate their expertise by being widely read and knowledgeable.

One lecturer commented on the seamless learning that can result from m-learning. This view was echoed by another lecturer who reported that lessons can continue in the absence of a lecturer and that the brick and mortar classrooms become irrelevant. The findings are consistent with the work of (Wong 2012; Wong 2015) who described seamless learning as a learning style where a learner can learn in a variety of scenarios that can be formal or informal, personal or social, and can be switched at any time. There were suggestions that using m-learning mode, teaching and learning would shift from a teacher-centred approach to a learner-centred approach. The lecturer would take a moderator's role and provide guidance. This was congruent with what was reported by another lecturer who stated that with the calls for student-centred learning, this empowers the learner and gives the learner control over his/her learning. Similarly, another lecturer suggested that because students have access to learning material this diffuses the responsibility from the instructor and allows students to learn concepts in a way best suited to them as individuals. It has been established that use of mobile technologies in teaching and learning can foster self-directed learning (Kong and Song 2015, Chang, Chiu et al. 2018). The m-learning mode is likely to encourage greater interaction among learners, and enable students to interact more effectively with the content.

A shared view was that m-learning would be convenient for lecturers. It was suggested that m-learning would make the lecturers' jobs easier, afford lecturers more opportunity to monitor students' progress and make it easy to supervise student research projects. It was suggested that m-learning will reduce much of the physical interaction between the lecturer and the students, giving lecturers more time to engage in research and development activities. One lecturer commented that m-learning would engender transformation in higher education sector and more students would have access to education. It was suggested that m-learning would be an improvement on the traditional approach. Another lecturer thought that m-learning could be an effective tool for universities in Zimbabwe. There are expectations that m-learning will offer to learners more diverse learning approaches beyond the current traditional approach. There is also an expectation that m-learning will grow rapidly in the next few years as a means of enhancing life-long learning. Another lecturer felt that m-learning could decrease the student population at tertiary institutions and that there would be reduced face-to-face interaction. There was a suggestion that m-learning offered an additional learning tool. One lecturer remarked that he had used virtual tours which enabled students to have a better appreciation of the subject matter. It was also suggested that m-learning made it easier to explain concepts.

One lecturer reported that mobile technologies enabled him to search for videos that gave practical examples of specific topics.

Another view was that m-learning could possibly bring excitement to the learning activities. It was reported that m-learning would improve language and literature learning, making it more interesting and interactive. Previous studies have found that the use of mobile technologies for learning was exciting for students (Valk, Rashid and Elder 2010; Pollara and Broussard 2011). One lecturer stated that the use of mobile technologies is a positive development that will improve the learning process from both the learners' and lecturers' perspective. Lecturers' comments on the impact of m-learning on teaching and learning are presented in Table 4.46.

Table 4. 46 Lecturers' comments on m-learning impact on teaching and learning

Respondents	Comments
Lecturer_3	*"This will reduce much time of interaction between the lecturer and the students and lecturers will have more time to engage in research and development activities."*
Lecturer_4	o *"It's a good concept, requiring the lecturer to be up to date and widely read on different subject matters, and allows strict deadlines to be adhered to where online submission is used."* o *"[m-learning] requires the lecturer to be on their toes all the time should the students require more answers from the lecturer."*
Lecturer_6	o *"This makes teaching and learning seamless. It is a big advantage and failure to attend classes will no longer be a serious drawback."* o *"That is true, the teacher/lecturer is placed in the background thereby fostering greater interaction between students and learning material and amongst students themselves. The teacher/lecturer plays the role of a moderator, supervisor and guide."* o *"Mobile learning would make the teaching and learning of language and literature more interactive and interesting if this is carefully worked out and implemented."*

Lecturer_7	○ *"This may even bring excitement in the learning activities."* ○ *"When illustrating some video role plays. At some point I used to teach E-commerce, we could do virtual tours with students, something that enabled them to have a better appreciation on e-commerce activities."* ○ *"It also makes it easier to explain concept."*
Lecturer_8	*"It will be a good improvement from the traditional approach."*
Lecturer_9	*"It offers one more additional tool for learning."*
Lecturer_13	*"It enhances learning and makes the lecturer's job easier."* *"Gives the lecturer opportunity to monitor progress of the students."*
Lecturer_15	*"Makes it easy to supervise student research projects."*
Lecturer_17	*"Certainly, this transforms the higher education sector and makes education accessible to more people."* *"The use of mobile devices is a positive development which will definitely improve the learning process from both the perspective of the learner and the instructor."*
Lecturer_22	*"This is a good direction to take. Using mobile learning is the way to go. Lessons can continue whilst the lecturer is flying abroad. The four-wall classroom is becoming irrelevant."*
Lecturer_24	○ *"With the calls for student-centred learning, this empowers the learner and gives the learner control over his/her learning."* ○ *"It is my expectation that learners will be better equipped and presented with more diverse learning opportunities than in the current scenario. I expect students to produce more results than in the current scenario."*
Lecturer_25	*"Could reduce congestion at universities, reduce the need for everyday face to face interaction with students."*
Lecturer_28	○ *"Mobile learning will probably grow rapidly in the next few years, especially as a means to enhance lifelong learning."* ○ *"I think mobile learning can be an effective tool for universities in Zimbabwe. The challenge is to that the prices for data are still quite high for many people."*
Lecturer_29	*"Student will be in possession of the material required for the method hence diffusing the responsibility from the instructor and also allowing the students to learn concepts in a way best suited to them as individuals."*
Lecturer_30	*"May not be universally applied since some students cannot afford to own mobile devices."*

4.5.11 New findings

The new findings from the interviews with lecturers are shown in Table 4. 47. Similarities with the initial proposed model and the data are depicted by black double-pointed arrows. Where the data collected is different from that in the initial proposed model, a red arrow is used; new findings emerging from the data shown in italics.

The m-learning challenges in the initial model matched the findings from the data collected from lecturers. Some new findings on the m-learning challenges emerging from the data included teaching and learning issues, issues with mobile devices, and the need for training.

According to the data, lecturers believe that the cost of mobile devices is still an obstacle to m-learning adoption. This does not align with the initial model, which suggests that the availability of cheaper mobile phones is a factor influencing m-learning adoption. Lecturers anticipate that there a number of m-learning potentials that can be realised through m-learning. They expect that institutions will provide mobile devices for m-learning. Another new finding was that lecturers would welcome a policy change to incorporate the use of mobile devices in teaching and learning. There are mixed views on how m-learning would affect self-learning; some lecturers expect that m-learning will encourage self-learning, while others believed that certain students could possibly benefit from m-learning, particularly those who were self-starters.

There are mixed views regarding the acceptability of m-learning mode of learning. For some lecturers, acceptability hinges on the availability of resources, while for others it has more to do with the courses they teach. There was, however, a consensus that m-learning could be beneficial in some parts of the different units of the various disciplines, and thus acceptable in those circumstances. It was therefore not surprising that blending was a common feature of both the collected data and the initial proposed model.

Table 4. 47 New findings from lecturers

Main aspects in initial proposed model	**New Findings in data collected**
M-learning challenges	**M-learning challenges**
Infrastructure	Infrastructure
Investment costs	Investment costs
Policies	Policies
	Teaching and learning issues
	Device issues
	Training
Factors influencing m-learning adoption	
Culture	
Cheaper mobile phones	**Factors influencing m-learning adoption**
HCI	Culture
	Cheaper mobile phones
	HCI
Pedagogy	
Learners' expectations	
Lecturers' expectations	
Digital divide	
connectivity	**Pedagogy**
M-learning characteristics	Learners' expectations
Portability	Lecturers' expectations
Blending	*M-learning potentials*
Collaboration	*Provision of mobile devices*
Training	*Policy change*
Usability	*Government and institutional support*
Connectivity	*Self-learning*
Ubiquity	*Acceptability*
Technical support	Learning theories
Interactivity	
Context	
Mobility	
	M-learning characteristics
	Portability
	Blending
	Collaboration
	Training
	Usability
	Connectivity
	Ubiquity
	Technical support
	Interactivity
	Context
	Mobility

Legend	
double pointed black arrow = similar findings from data and model	⟷
red arrow= findings from data contradict initial model	⟶
italics = new finding from data collected	***italics***
normal print = aspects in the intial model not discussed in data collected	normal print, no arrows, no italics

4.6 IT support staff

Random sampling was used to recruit IT support staff. The resulting sample is shown in Figure 4.20.

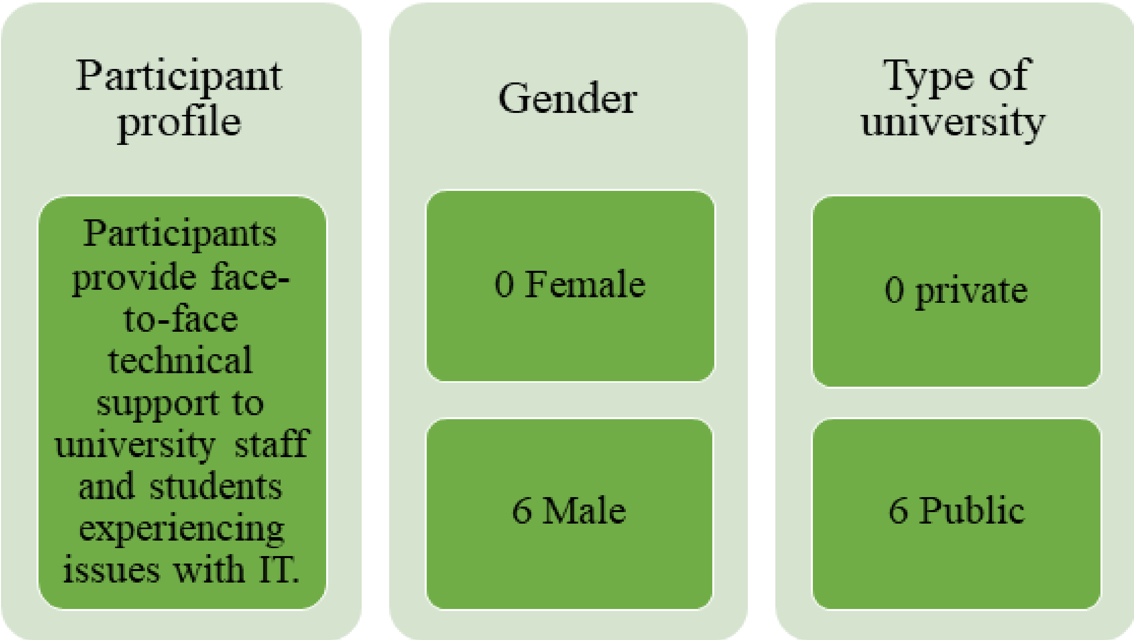


Figure 4. 20 Sampling of IT support staff

4.6.1 Familiarisation with the data

The responses received via email from the IT support staff constituted the qualitative data. These were read and re-read a number of times so that the researcher could become very familiar with the contents, and notes were taken. Appendix I lists the respondents and first impression notes. The respondents were identified by code instead of their actual names.

The data collection involved sending emails to the potential participants who are the IT support staff in Zimbabwe universities. The emails were sent between February and April of 2018. A total of twenty-five emails were sent to the various tertiary institutions. Several follow-up emails were sent after two weeks when there was no response. Each response was read on receipt, and notes made on first impressions. Four respondents responded via email, two respondents opted to print the questions and then filled in their responses and the responses were scanned.

Some participants provided more details than others in their written responses. There were six pages of responses with the interview data comprising 549 words. The reading and familiarisation with the data took about five hours for the six participants. Interpreting the data was done using highlighter pens, pen and paper and took about eight hours.

4.6.2 Generation of initial codes

The themes that emerged from the collected data were theory-driven. An example of the generation of initial codes based on the statements from the data collected from the IT support staff is shown in Table 4.48.

Table 4. 48 Generation of initial codes-IT support staff

Statement	**Code(s)**
There should be enough bandwidth to connect all users. The service should be available campus wide.	Infrastructural problems
It [m-learning] is the way to go as it offers flexible learning and teaching methods.	Flexibility
Connectivity, lack of know-how, limited resources, limited time and availability of technical staff	Infrastructural problems Inadequate technical staff
It is possible but the network is not integrated, there is no seamless connection to the wireless network (roaming). As the number of students accessing the network increases the performance of the network is degraded significantly.	Infrastructural problems
If some measure are taken so that cheating will be minimised on examinations (that is if they will be taken on these devices) I think it will help a lot.	Cheating
It's a win-win scenario for both learners and teaching staff. E-learning enables teaching staff to pre-package their teaching material allowing for more efficient reuse, hence they have more time for hands on assistance of learners. On the other hand learners have complete access to their learning resource 24/7 enabling them to study more efficiently and at their own pace	Benefits of m-learning Increased access to learning material

These themes and their meanings are shown in Table 4. 49. No new themes emerged from the actual data collected.

Table 4. 49 Theory-driven codes and meanings (by researcher)

Theory-driven code	Meaning of code
Anticipated benefits of m-learning	The potentials of m-learning
Challenges of using mobile devices	The cons of using mobile devices

4.6.3 Searching for themes

The themes that emerged are shown in Figure 4. 21.

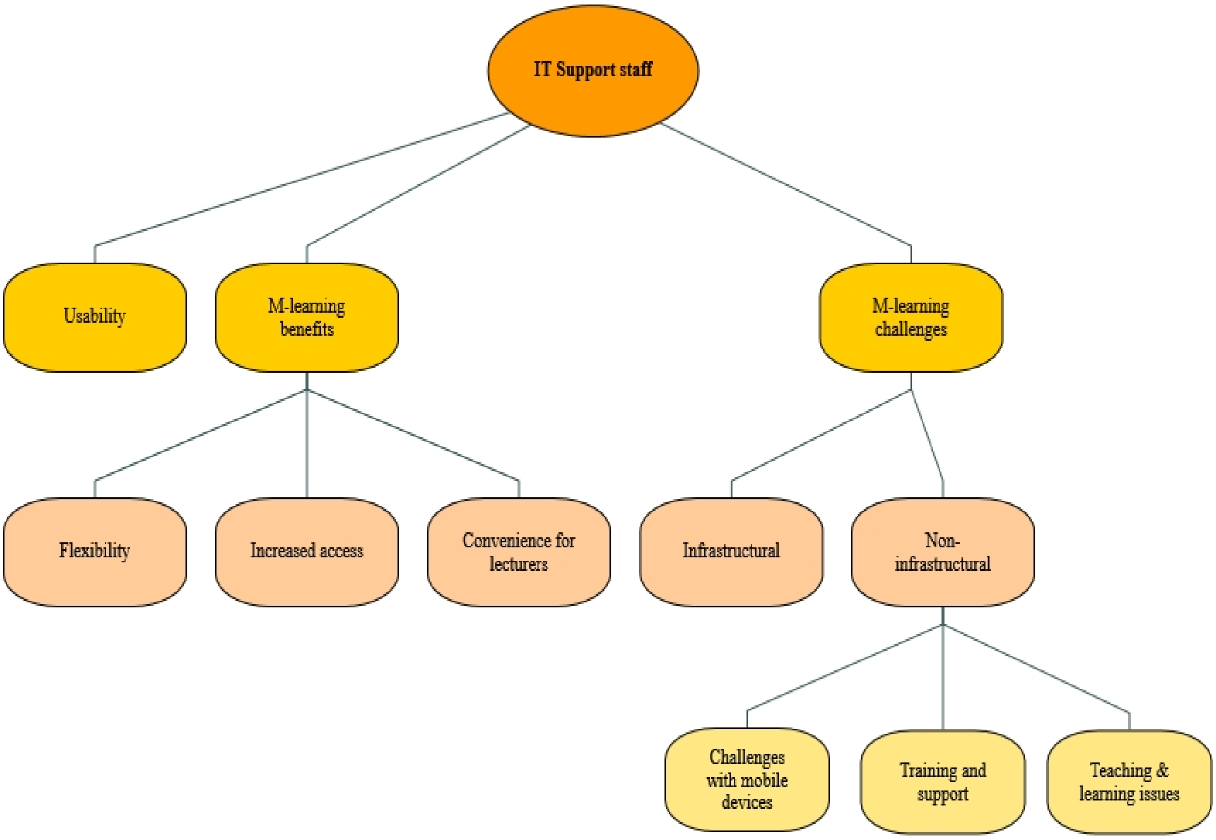


Figure 4. 21 Set of themes for IT Support staff (prepared by researcher)

4.6.4 Themes

The themes that emerged from the interviews conducted with IT support staff were (Figure 4. 22):

- Usability
- Challenges of m-learning
- Benefits of m-learning

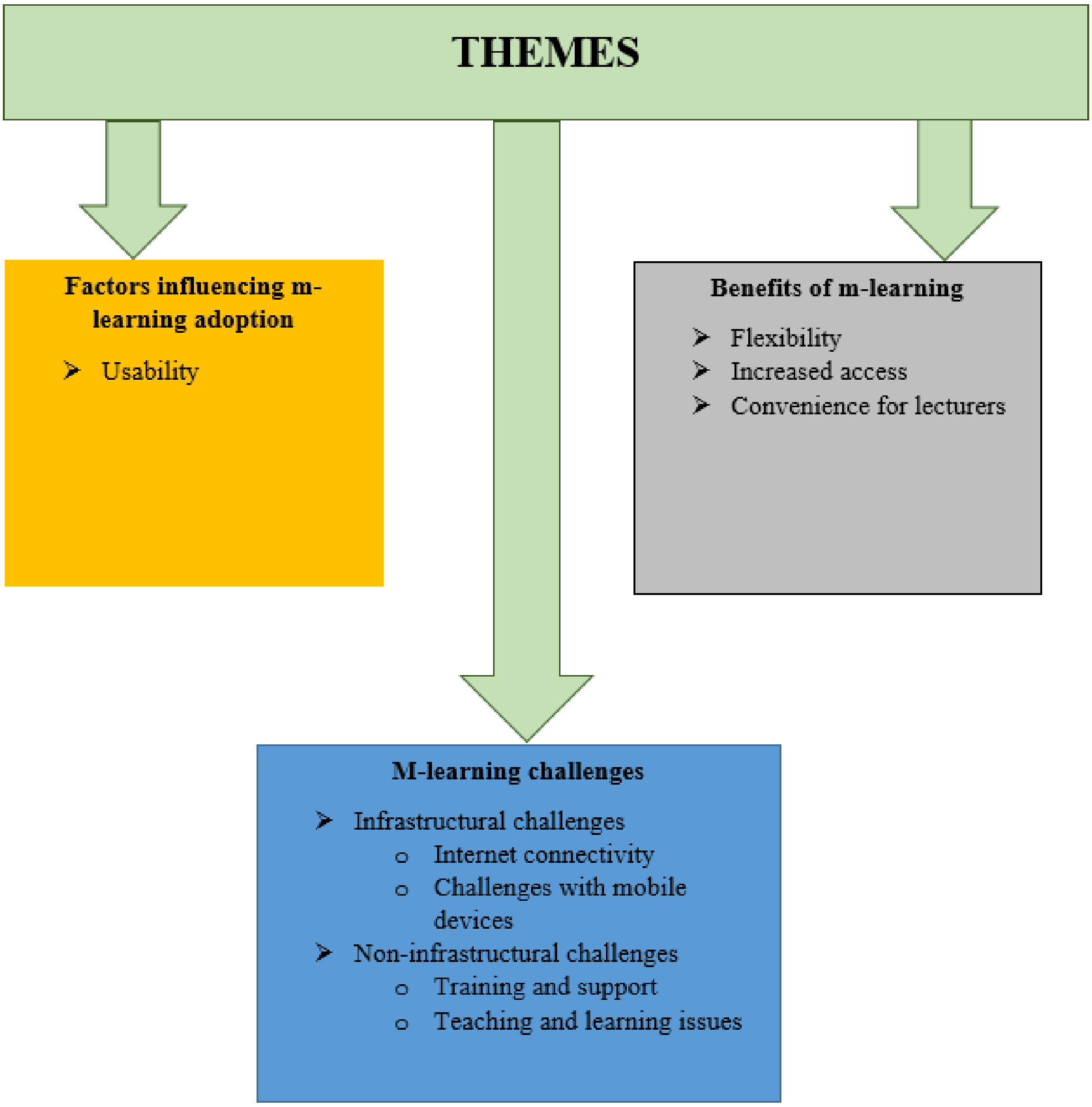


Figure 4. 22 Themes and subthemes from interviews with IT Support staff

4.6.3.1 Theme 1: Usability

The number of students and lecturers who connect to university networks varies depending on the size of the university. According to the IT support staff in the various universities, the number of learners and instructors connecting to the university network from mobile devices ranges between 1 000 and 20 000. At the tertiary institutions that have less than 3 000 people connecting to the university network, the IT Support staff reported that both lecturers and learners did not often require technical or IT support. Half of the IT Support staff who responded were from tertiary institutions that had less than 3 000 people using mobile devices to connect to the university network. When asked about the frequency of learners and instructors requiring technical or IT support, in two cases it was suggested that both learners and instructors hardly required and IT or technical support.

> [IT_Support_1]: *"Not so often, unless if there is a technical problem with the system."*

> [IT_Support_2]: *"On rare occasions for instance when they [students and lecturers] have forgotten their passwords or when their devices have problems connecting."*

> [IT_Support_5]: *"So often because some of the devices when they reboot they lose configurations."*

The other IT support staff who responded were from institutions that had in total over 5 000 students and lecturers who connected to the university networks using mobile devices. In these institutions, the IT support staff reported that each day they attended to at least 15 people who required technical or IT support. One of the respondents pointed out that the IT support was usually required at the beginning of the semester.

> [IT_support_6]: *"Mainly during the start of the semester, login issues are the most common, forgotten or lost credentials."*

While usability is less extensively covered in the technological aspects of m-learning, it is identified as one of the several facilitating aspects of mobile technologies (Ali et al. 2015). The findings in this study point to the ease-of-use and the efficiency of mobile technologies for learning which aligns with the findings of (O'Connor and Andrews 2015; Imtinan, Chang and Issa 2013). It is not surprising that most students will find it easy to use mobile devices for learning purposes given that a majority of them are millennials and have generally taken a lead in the adoption and use of technology. The comments displayed in Table 4.50 indicate that usability is not a major issue in Zimbabwe tertiary institutions.

Table 4. 50 IT support staff comments on usability

Respondents	Comments
IT_Support_1	*"Not often unless there is a technical problem with the system."*
IT_Support_2	*"On rare occasions for instance when they [lecturers or learners] have forgotten their passwords or when their devices have problems connecting."*
IT_Support_3	○ *"Lack of know-how."* ○ *"Limited Time and availability of technical staff."* ○ "Also limited Technical support." ○ *"No [to ability to provide training] due to lack of resources and willingness [by lecturers]."*
IT_Support_4	*"Yes it [institution] is able to train as it has hosted the Advanced IEEE Web and Multimedia Integrated teaching methods."*
IT_Support_5	*"Yes it [department] will be able for we have the facility to train teachers."*
IT_Support_6	*"Yes training and support are provided as requested and on a periodic basis to ensure maximum uptake of eLearning within the university."*

4.6.3.2 Theme 2: Challenges

The m-learning challenges identified by IT support staff concerned: (1) infrastructural challenges and (2) non-infrastructural challenges. These challenges are presented in Table 4. 51.

Table 4. 51 Infrastructural and non-infrastructural challenges identified by IT support staff

Infrastructural challenges IT support discussed inadequate infrastructure in terms of: ➢ Poor Internet connectivity ➢ Insufficient bandwidth ➢ Limited locations with internet access at universities ➢ Congestion at access points These findings are consistent with earlier findings that internet connectivity is a barrier to m-learning (O'Doherty et al. 2018; Okai-Ugbaje, Ardzejewska, and Ahmed 2017). ➢ Availability and accessibility of mobile devices a challenge for some learners. ➢ Learners have different types of mobile devices which give with some being incompatible with the technological infrastructure at the universities. These findings confirm the findings of Pachler, Bachmair, and Cook (2010), that it is not easy to deal with different models and types of mobile devices in terms of compatibility and media convergence. Yousafzai et al. (2016) suggest that given the plethora of available mobile device hardware and software, benefits of m-learning can only be realised when learning systems are designed to handle this heterogeneity.
Non-infrastructural challenges ➢ Inadequate technical support as there is not enough manpower to provide technical support. Technical support and availability of competent technical support staff is significant for m-learning success (Munguatosha, Muyinda, and Lubega 2011; Iqbal and Bhatti 2016). ➢ Some academic staff are unwilling to be trained due to lack of interest or knowledge of m-learning. ➢ M-learning will be a source of distraction from academic work. Anshari et al. (2017) recommend that lecturers take measures to minimise distractions, and concede that mobile devices can be a source of distraction and can procrastinate learning progress.

The IT support staff comments on connectivity are shown in Table 4. 52. It is not surprising that most of the IT support staff reported on the poor Internet connectivity; however, it is encouraging that most institutions have Internet connectivity.

Table 4. 52 IT support staff comments on m-learning challenges

Respondents	Comments
IT_Support_1	o *"They[students and lecturers] may encounter connectivity problems"* o *"There should be enough bandwidth to connect all users."* o *"The service should be available campus-wide."*
IT_Support_2	o *"There is no wireless signal coverage in some areas."* o *"Congestion where there are access points."* o *"Server infrastructure needs to be upgraded."* o *"Devices have problems connecting."*
IT_Support_3	o *"Connectivity"* o *"Limited resources"* o *"Bottleneck is the resources."* o *"Bandwidth challenges"* o *"Gadget availability and accessibility"* o *"Limited time and availability of technical staff."* o *"Lack of know-how"*
IT_Support_4	*"The issue of resources and bandwidth."* *"The network uses a proxy server and most of the times refuses connections to some applications and technologies used by students and staff."* *"Mobile learning devices availability"*
IT_Support_5	*"Many will not be able to configure the devices at first use but as they continue using it they will be able to configure and use the devices."*

4.6.3.3 Theme 3: Benefits of m-learning

The IT staff identified various benefits of m-learning, in particular the flexibility that enabled learners to study at their own pace in a more convenient manner. The findings confirm those of (Jacob and Issac 2007; Asiimwe and Grönlund 2015; Warren, Lee and Najmi 2014). One participant stated that m-learning would improve the quality of learning because it gave increased access to educational resources. This benefit was also reported by (Cheng et al. 2010; Althunibat 2015; Iqbal and Bhatti 2016), and is very significant for resource-constrained contexts.

Another benefit identified by an IT support staff was that m-learning would reduce the demand on the lecture theatres. Another remarked that the use of mobile technologies in teaching and learning was a *"win-win scenario for both learners and teaching staff"* as instructors could pre-package the learning material allowing for re-use, thus freeing up time to further assist students. From the students' perspective, the benefits identified were that they had increased access to the learning resources 24 hours a day. These findings indicate the convenience that m-learning offers to both instructors and learners.

4.6.4 New findings

The new findings from interviews with IT support staff are shown in Table 4. 53. Similarities between the initial proposed model and the data are depicted by black double-pointed arrows. Where the data collected is at odds with what was in the initial proposed model, a red arrow is used with new findings emerging from the data shown in italics.

There were not many findings that matched the initial proposed model. The few that did included infrastructure as a m-learning challenge, training, and technical support under m-learning characteristics. It was not surprising that IT support staff were the only stakeholders to consider usability as a factor influencing m-learning adoption.

New findings emerging from the data collected from the university IT support staff included that the incompatibility of mobile devices is a factor affecting m-learning adoption. IT support staff expected that the implementation of m-learning would reduce the number of lecture rooms required, and would offer a flexible means of engaging in teaching and learning. This flexibility was one factor that was added by the IT support staff.

Table 4. 53 Findings: IT support staff

Main aspects in initial proposed model	New Findings in data collected
M-learning challenges	**M-learning challenges**
Infrastructure	Infrastructure
Investment costs	Investment costs
Policies	Policies
Factors influencing m-learning adoption	**Factors influencing m-learning adoption**
Culture	Culture
Cheaper mobile phones	Cheaper mobile phones
HCI	HCI
Usability	Usability
	Incompatible devices
	Reduce demand on lecture rooms
Pedagogy	
Learners' expectations	
IT support staff expectations	**Pedagogy**
Learning theories	Learners' expectations
	IT support staff expectations
	flexible teaching and learning methods
	Learning theories
M-learning characteristics	**M-learning characteristics**
Portability	Portability
Blending	Blending
Collaboration	Collaboration
Training	Training
Usability	Usability
Connectivity	Connectivity
Ubiquity	Ubiquity
Technical support	Technical support
Interactivity	Interactivity
Context	Context
Mobility	Mobility
	Flexibility

Legend	
double pointed black arrow = similar findings from data and model	⟷
red arrow= findings from data contradict initial model	→
italics = new finding from data collected	***italics***
normal print = aspects in the intial model not discussed in data collected	normal print, no arrows, no italics

4.6 Interview data summary

The impact of poor infrastructure on m-learning adoption has been widely documented, particularly for developing countries. The relevance of Internet infrastructure for m-learning is clearly supported by the current findings. Beyond the issue of infrastructure in developing countries such as Zimbabwe, there is evidence that there are a number of issues that may hinder m-learning implementation and adoption.

Another major finding was that the use of mobile phones for teaching and learning will probably not be easily embraced. Most stakeholders indicated that learners could not afford suitable mobile phones. The study has confirmed that despite the high mobile phone density in some countries, most of the mobile phones are unsuitable for teaching and learning purposes. A significant finding to emerge from this study is that the stakeholders feel the inherent problems of mobile devices could hinder m-learning. There is a strong sense among the stakeholders across the board that m-learning would be a distraction from academic work. With regards to pedagogy, the findings show that most stakeholders perceive m-learning as a vehicle that could encourage poor learning habits.

On a positive note, stakeholders across the board are keen to embrace m-learning because it promotes collaboration, increases access to academic resources, and is convenient for teaching and learning. Most stakeholders appreciate the need for training if m-learning is to be successfully implemented and adopted.

The findings show that different stakeholders focus on different issues when considering m-learning implementation and adoption. For example, only lecturers discuss self-learning; library staff are the only ones concerned about the digital divide; and IT staff are concerned about usability. At present, there is no apparent holistic approach to m-learning implementation and adoption in Zimbabwe.

4.7 Modification of model

The initial original model is depicted in chapter 2. Based on the new findings, the model for m-learning will include new aspects under challenges, characteristics, and pedagogy. Some aspects remain unchanged from the proposed initial model.

Based on the findings from the email interviews, there will be modifications to the proposed initial model.

- The modifications will reflect the new findings such as the benefits of m-learning, which will be considered as factors that influence m-learning adoption.
- There are several issues related to mobile devices and m-learning perceived as “undesirable” which will be classified as **m-learning issues**. Although these will not be classified as challenges, there is a need to address these issues. M-learning challenges will be defined as obstacles or anything that prevents or blocks m-learning implementation.
- Some aspects of the proposed initial model were not discussed at all by the stakeholders. It is likely that these are not areas of interest to them, although these aspects will be investigated further to ascertain their position in the model.

The modified model is depicted in Figure 4. 23.

M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning characteristics
✱ *Distraction to academic work* ✱ *Device issues* ✱ *Poor learning habits* ✱ *Privacy*	⊙ Infrastructure ⊙ Cost of infrastructure ⊙ Policies ✱ *Unsuitable mobile devices* ✱ *Digital divide*	⊙ Cheaper mobile phones ⊙ Culture ⊙ Usability ⊙ HCI ✱ *Affordability of mobile devices Mobile devices more accessible than laptops or PCs* ✱ *Advance STEM* ✱ *Institutional support* ✱ *Acceptability of m-learning*	⊙ What constitutes learning? ⊙ Learning theories ⊙ Stakeholders' expectations ✱ *Dynamic learning* ✱ *Self-learning*	⊙ Connectivity ⊙ Ubiquity ⊙ Mobility ⊙ Training & support ⊙ Collaboration ⊙ Blending ✱ *Increased access* ✱ *Convenience* ✱ *Flexibility* ✱ *Self-learning* ✱ *Personalised learning*

Figure 4. 23 Modified model after interviews

Key for themes and sub-themes from findings:

Prefix to sub-theme	Meaning
⊙	Sub-theme emerging from literature in initial model
✱	Sub-theme emerging from interviews

4.8 Conclusion

This chapter analyses the data collected by employing the six-step thematic analysis. A total of fifty-two (52) email interviews was done. The chapter gives an example of how the initial codes were generated for each of the stakeholders. A variety of themes emerged from the interviews with the different stakeholders. The themes that emerged from the interviews confirm aspects of m-learning generated from the literature review. These are: (1) m-learning challenges, (2) m-learning characteristics, (3) factors that influence m-learning adoption and (4) pedagogy. Several additional sub-themes were generated by the interviews. For each of the stakeholders a comparison of the aspects of the initial model to the new finds emerging from the data collected was done. The new findings from each of the stakeholders were collated and used in refining the initial proposed model. From the interviews, a new theme emerged: **m-learning issues**. M-learning issues are those aspects or characteristics of m-learning or mobile technologies that are undesirable, while m-learning challenges are those obstacles that block m-learning implementation. For example, a small screen size is a m-learning issue as this is undesirable however inadequate infrastructure is a challenge as it can hinder m-learning implementation. Under the new themes m-learning issues, the undesirable elements that emerge from the interviews are (1) distraction to academic work, (2) inherent problems of mobile devices, (3) poor learning habits and (4) privacy. The modified model after analyses of the interviews is presented in this chapter. The modified model reflects the new aspect m-learning issues. The findings from the data analyses were considered when the focus group questions were being formulated. Chapter 5 presents the findings from the analysis of focus group data.

Chapter 5

5. Focus group discussions data analysis

5.1 Introduction

Chapter 4 provided an analysis of the interview data. The analysis revealed a set of themes on aspects of m-learning in Zimbabwe. The purpose of this study was to investigate the feasibility of implementing m-learning in tertiary institutions with a focus on both academic and administrative support in emerging economies such as Zimbabwe. This chapter follows the first phase of the qualitative approach data analysis (interviews) chapter which discussed the data analysis method used to analyse the email interview data collected from some of the key stakeholders.

This chapter describes the second phase of the qualitative approach. Qualitative data was collected from learners in Zimbabwe tertiary institutions in order to answer the research questions via focus group discussions. Two phases made up the qualitative approach. This chapter starts by discussing the sampling of the focus groups; this is followed by the data analysis method used to analyse focus group discussion among students from Zimbabwe universities. The chapter then discusses new findings that emerged from the students' discussions. Finally, an overview of all findings is presented, and the chapter concludes with a modification of the initial proposed model in order to incorporate the new findings.

5.2 Focus group sampling

Three focus group discussions were conducted at three different institutions. As discussed in section 3.9.6, a call for participants was sent out to different institutions, asking for both undergraduate and graduate students. Purposeful sampling was used as it was important to determine those learners who were familiar with the notion of m-learning, as discussed in section 3.9.9. It was essential to have participants who would provide meaningful insights during the discussions. A total of twenty undergraduate students participated in the focus group discussions, comprising eleven males (55%) and nine females (45%). Table 5.1 gives the focus group information. The details of group membership and the recruitment of students are discussed in section 3.9.6.

Table 5. 1 Focus group information

Focus Group	Participants	Gender	Focus group recording information
Institution 1	FG_Member1	Male	• Audio recorded. • Discussion time: 36:08 minutes • Transcription time: 144 minutes
	FG_Member2	Male	
	FG_Member3	Female	
	FG_Member4	Female	
	FG_Member5	Male	
	FG_Member6	Male	
	FG_Member7	Female	
Institution 2	FG_Member8	Male	• Video recorded • Discussion time:53:28 minutes • Transcription time:216 minutes
	FG_Member9	Male	
	FG_Member10	Male	
	FG_Member11	Female	
	FG_Member12	Male	
	FG_Member13	Male	
Institution 3	FG_Member14	Female	• Video recorded • Discussion time: 72:01 minutes. • Transcription time: 284 minutes
	FG_Member15	Female	
	FG_Member16	Female	
	FG_Member17	Female	
	FG_Member18	Female	
	FG_Member19	Male	
	FG_Member20	Male	

5.3 Thematic analysis

Focus group data were analysed following the thematic analysis process as discussed in section 4.2.

5.3.1 Familiarisation with data

To familiarise herself with the data collected from focus groups, the researcher listened to the recordings several times and then transcribed them. The transcriptions were exported to NVivo12 Pro software.

5.3.2 Generation of initial codes

The generation of codes again was done using a hybrid approach consisting of deductive and inductive methods. A total of 54 codes and 589 references were recorded in NVivo 12 Pro. A total of twenty-nine nodes was initially generated for the twenty participants.

Figure 5.2 is a snapshot of some of initial codes from the twenty-nine nodes taken from NVivo 12 Pro.

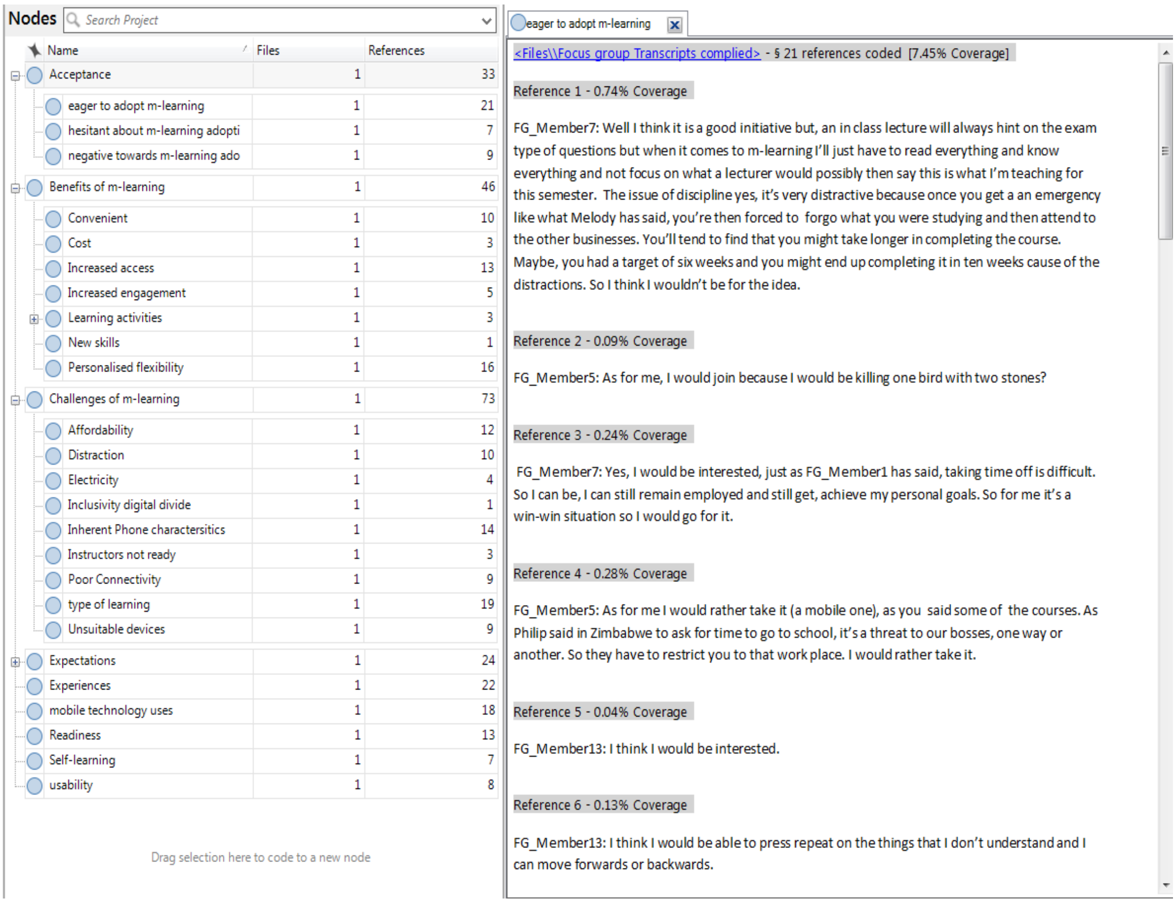


Figure 5. 1 Nodes extracted taken from NVivo software

An example of the generation of the initial codes based on the responses from the students is shown in Table 5.2

Table 5. 2 Generation of initial codes for students

Statement	Code(s)
Yes, I can be ready to use my phone but those distractions we were talking about. Probably you're going to receive an emergency message there so you're going to check on it, you get distracted, probably you have to reply a number of people but at the same time you are supposed to concentrate, so it will vary with the situation that you are in. Sometimes, yes, I can actually work with a phone.	Distraction
I would not be interested. Maybe it's just a type of view or stereotype, where people often look down upon courses that are taught in such a manner-distance learning	Credibility of online learning
Yes, I think if the lecturers are well trained then it will be more effective as when it is e-learning , when you send, probably your statement it may even, like even on social media when you send a message the person may get the message in another way. So even when you send a message, maybe there should be terms that explain things clearly. I think it will be effective.	Training
Yeah just adding to what she said. Yeah it just adds convenience to anywhere that you are, you can have information. So it actually ends up saving resources it's not necessary to have chairs and tables in the room for the lecturer to give the information, even at home the lecturer can deliver the information.	Convenience Factors influencing m-learning adoption
The greater part of the people, they do have devices but we still have a number of others that don't	Affordability
I think when you look at Zimbabwe generally data is expensive. So when you want to access video content, you need to pay a lot more because it takes up more data and with our bundles that we have it will not sustain you much cause of the price. If it were inexpensive it would not be a problem but with the price that we have here in Zimbabwe it becomes a little difficult to access Internet.	Affordability
I think our first vacation in first year we did some IKAE workshop and our lecture, came with his app called Tolgate which can be used for attendance and it can also be used for answering questions during the lectures. So you just login his domain and you can answer the question and it would appear on the screen.	Experience with m-learning

5.3.3 Emergent themes

Five themes emerged during analysis of the focus group data. The themes are shown in Figure 5.2. They are: (1) current use of mobile devices (2) benefits of m-learning, (3) challenges of m-learning, (4) pedagogy and (5) m-learning acceptance. These themes and their sub-themes are discussed in the following sections.

5.3.4 Theme 1: Current use of mobile devices

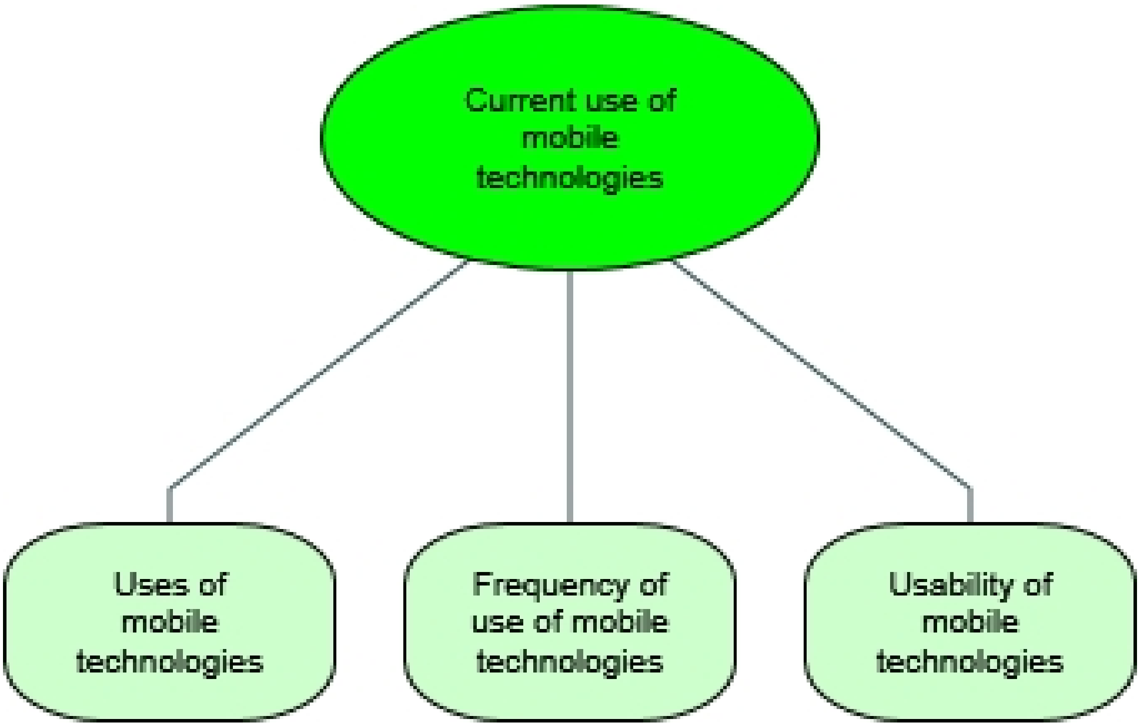


Figure 5. 2 Current use of mobile devices (by researcher)

5.3.4.1. Uses of mobile technologies

University students use mobile devices for a major part of the day. Most learners use mobile devices to access social media platforms such as Facebook, twitter, Instagram and WhatsApp. Some learners use their mobile devices to access study materials while others use these devices to access emails. On a daily basis, students use mobile devices for at least three hours to as many as 10 hours. These findings reflect those of previous studies (Kaddu and Haumba 2017; Lai and Hong 2015; Sponcil and Gitimu 2013). There is high usage of social media amongst tertiary students in Zimbabwe.

5.3.4.2 Frequency of use of mobile technologies

Most learners use mobile technologies to access social media platforms, with other learners using these technologies to access academic material. The frequency of use of mobile technologies by Zimbabwean university students is comparable to that of other tertiary students in other countries (Lai and Hong 2015; Reese Bomhold 2013). Some learners, however, expressed that while they would like to use mobile devices more, there were some restrictions that included cost because browsing the Internet on mobile devices is very expensive. Some learners had problems with the network in certain locations, while others mentioned power cuts. Other learners discussed work commitments that did not allow them to be on their phones. One learner indicated that he spent on three hours on the Internet because he downloaded material which he would access later. Some of the participants' comments on the use and frequency of use of mobile technologies are presented in Table 5. 3.

Table 5. 3 Participants' comments on use and frequency of Internet use

Participants	Remarks
FG_Member6	➢ *"On the internet? Uh, not very frequent but using the mobile phone on social networks; any spare time you get you're always on your phone.* ➢ *Facebook, Instagram, Twitter."*
FG_Member10	➢ *"My project is heavily reliant on the internet. Where I need it's actually in software development. So most of the things I will do rely on the internet. So when it comes to how much time I spend on the internet...uh...So it won't be 24 hours a day, but almost a greater part of the day.* ➢ *Yeah, I can't live without it."*
FG_Member17	➢ *"I think it takes up a bulk of my day because I am also in IT. So you find that no one is going to tell me what bugs I have, so in order to fix them, I have to go on YouTube. So the bulk of my day is spent.* ➢ *I think only when I close my eyes going to bed because I'll be constantly thinking, like okay, I'm solving a problem. Like even with CISCO, everything is online so if I don't understand a concept, I'll be going on YouTube so basically my whole day is actually spent on the internet."*
FG_Member19	*"Yeah so you know, WhatsApp, Twitter, you'll be following the updates so you know ah, most of the day."*

5.3.4.3 Usability of mobile technologies

Usability is a major theme in human-computer interaction (HCI) research. Usability is commonly associated with ease-of-use, as discussed in section 2.8.1.9. Learners are comfortable with the use of mobile devices, with most learners indicating that they do not require technical support. Most learners reported that they have used mobile devices and the Internet for a long period. To draw comparisons between the usability of mobile technology and the use and frequency of mobile technology, a comparison diagram from was generated by means of NVivo 12 Pro, as shown in Figure 5. 3.

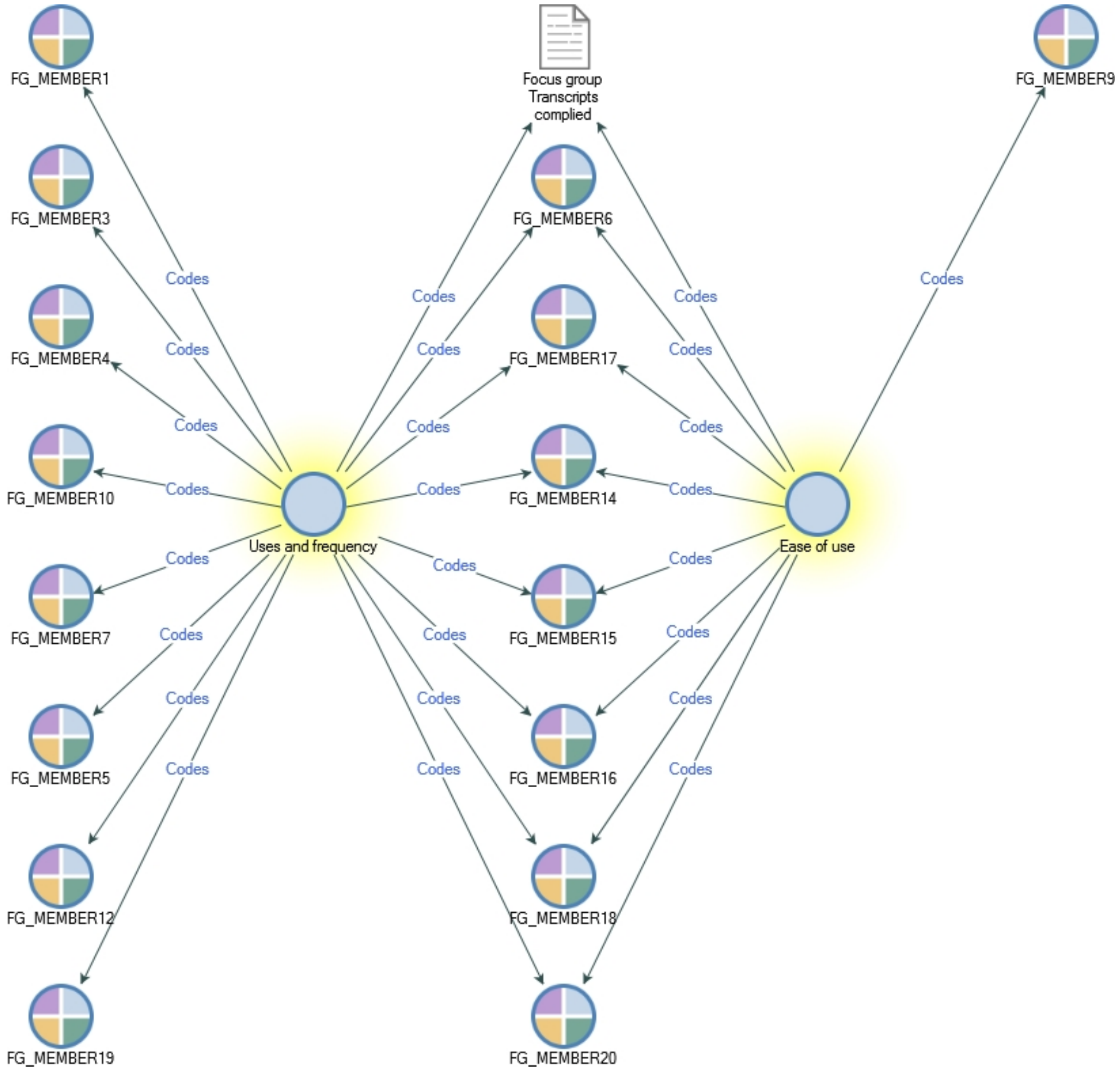


Figure 5. 3 Comparison of usability vs uses and frequency of use of mobile technologies

Figure 5.3 compares usability versus uses and frequency of use of mobile technologies for each of the participants.

- Eight participants discussed what they use mobile technologies for and how often (FG_Member1, FG_Member3, FG_Member4, FG_Member10, FG_Member7, FG_Member5, FG_Member12, FG_Member19)
- Between the 2 nodes in the middle of the diagram, are seven participants who discussed both ease of use and uses and frequency of use of mobile technologies.

- Only one participant discussed ease-of-use, without relating it to usage and frequency of use of mobile technologies.

A closer examination of participants' comments found in the middle section (those participants who discuss both usability and uses and frequency of use of mobile technologies) in Figure 5.3 indicates that these participants can use mobile technologies competently. These students use mobile technologies to access academic resources. In addition, some of them are undertaking ICT courses and are technically savvy; they appreciate the processing powers of mobile technologies and how their portability and light weight allow more flexibility to access online resources.

The only participant who discussed ease-of-use did so in relation to the use of social media for academic purposes.

> [FG_Member9]: *"I would say YouTube has really helped me a lot to cover that gap from tutorials."*

It was interesting to note that most students who focussed only on the uses and frequency of use of mobile technologies, were mostly concerned with the factors that limited their access to online resources, such as network connectivity, power cuts and costs. Unsurprisingly, the limitations discussed by some participants have a significant influence on how these participants use mobile technologies. Participants' comments on what limits use of mobile technologies are shown in Table 5.4.

Table 5. 4 Participants' comments on what limits use of mobile technologies

Participants	Remarks
FG_Member1	➢ *"And also work commitments. Sometimes times you are at work and you don't have to be always on the phone."* ➢ *"And you have to have a reliable phone because if it's one of those phones that quickly die out or run out of battery then you have a very big problem accessing."*
FG_Member3	*"And sometimes when there are power cuts, you won't be able to access the network. The network will be bad. You won't be able to go on the internet."*
FG_Member4	*"Yeah, and I think sometimes problems of the network in some areas, especially in Zimbabwe. Sometimes we don't have to use it."*
FG_Member5	➢ *"The issue of network again, comes into play."* ➢ *"But yeah the issue of affordability."* ➢ *"During browsing, it (the phone) can freeze."*
FG_Member7	*"I think it's the issue of cost that could be a restriction. Because for me to be using Facebook or browsing the internet using my mobile device is a cost."*

5.3.5 Theme 2: Benefits of m-learning

Students in Zimbabwe universities believe that the benefits of m-learning depend on the portability of mobile devices. The benefits of m-learning were discussed in terms of convenience, increased engagement, increased access, different learning activities and flexibility (Figure 5. 4).

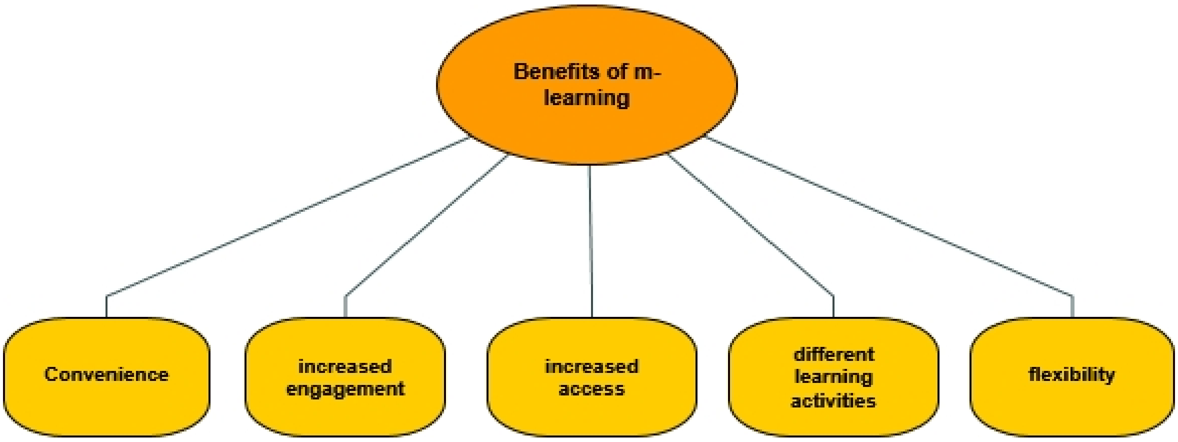


Figure 5. 4 Benefits of m-learning, and sub-themes

5.3.5.1 Convenience

Convenience in this context refers to the extent to which media makes it easier for users to save their time and effort. A major benefit of m-learning discussed by students in Zimbabwe was convenience. One student mentioned that content could be accessed via mobile technologies (Anshari et al. 2017; Oyelere et al. 2016). In the same vein, another student considered how m-learning would save travelling costs given that some students were working and had to travel long distances for classes. Another student considered the light weight of mobile devices, which are lighter than textbooks. The portability of the devices according to this student means students do not have to carry heavy text books all the time but can still access learning material wherever they are, this corroborates the findings of (Iqbal and Bhatti 2016; Lan et al. 2016). M-learning is convenient because of the access to online learning resources.

One student highlighted that through m-learning learning was not limited to a specific location and that discussions could be conducted without being in the same physical location. Another student highlighted that with m-learning, less furniture and rooms would be required and that there would be a shift from depending heavily on the instructor coming to the classroom/lecture theatre but that the same content could still be delivered to students in their various locations. Some students discussed the beneficial aspect of being able to rewind audio/video content to gain better understanding. Some students discussed the benefit of submitting assignments remotely without going to the university campus. These findings reflect previous findings that found that students were interested in m-learning because of its convenience (Iqbal and Bhatti

2016; Cheng 2015; Lakshminarayanan, Ramalingam and Shaik 2015; Milošević et al. 2015). The flexibility of m-learning makes it convenient as students control their learning.

One student commented that m-learning reduced physical contact with instructors. According to this student, fewer resources would be required compared to traditional classrooms. Another student highlighted that with m-learning, less furniture and fewer rooms would be required and that there would be a shift from depending heavily on the instructor coming to the classroom/lecture theatre, but that the same content could still be delivered to students in their various locations. Participants' commence on the convenience of m-learning are presented in Table 5.5.

Table 5. 5 Participants' comments on the convenience of m-learning

Participants	Remarks
FG_Member4	*"For me, I think I am ready considering the life we are living right now the busy life, for example this program (the one she is doing), perhaps if it was m-learning it would be better, we would have saved costs of coming here to Masvingo meeting the lecturers. At least it would have been easier, we would have managed given that we go to work. So I think it would have been a great advantage for me.*
FG_Member7	*"Yes, maybe scheduled times can be set aside for the practicals but for the theory part if they are pre-empted on the mobile learning device, it could be very convenient."*
FG_Member10	*"Yeah it just adds convenience to anywhere that you are, you can have information. So it actually ends up saving resources it's not necessary to have chairs and tables in the room for the lecturer to give the information, even at home the lecturer can deliver the information."*
FG_Member12	*"The idea that some lecturers like the part time lecturers will want to come in at 5 and other ones will want to come in during the weekends or maybe the lecturer takes two weeks when they aren't around. So there is no continuity or flow of information. If there is mobile learning knowing that he could deliver the coursework from wherever he is somehow it's convenient."*
FG_Member13	*"Uhm, we can have lectures right. Discussions can be conducted also and I guess the issue of assignments, yeah you can get your assignment on these devices and also submit your assignments."*
FG_Member14	*"The devices that are used are much lighter compared to the textbooks that are used. We don't have to carry around the textbooks or notebooks you can just use your phone. Also it can be accessed on multiple devices. One could use their mobile phone, tablet and even PCs to access content."*
FG_Member17	o *"I found it to be very effective because like you said, if I'm watching a video and I missed a concept I can always go back, as opposed to in the physical lectures, I would either be stopping the whole class waiting for the teacher to explain or I would need to meet the teacher after class and sometimes they are in a rush to go somewhere else after."* o *"So I think it is very useful in the sense that it doesn't restrict us in terms of, if we don't want all our data from Harare, we could easily send people all over and the information would be easy to compile it into a database because everyone has a mobile phone."*

5.3.5.2 Increased engagement

A number of students reported that m-learning was more engaging than the traditional method of learning that just had the instructor as the main source of knowledge (Alioon and Delialioğlu 2019; Lindsay 2016). One student argued that m-learning provided alternative sources of information, such as videos, about concepts that were not clearly understood from textbooks.

Another student suggested that m-learning enabled students to be specific in searching for particular information e.g. on You Tube, rather than going through various textbooks. One student highlighted that m-learning gave access to other sources of information, thereby reducing dependence on the teacher; the student further suggested that m-learning enabled students to pass on information by producing tutorials that could be helpful to their peers. This student added that students could relate more to fellow students than to their lecturers, and that students as young as 13 years old were developing online tutorials that were helpful to university students.

Another student focussed on how the technology made it easier for shy students to engage with instructors behind the screen rather than face-to-face. Another student still focussing on the technology discussed how she had an experience with a visiting lecturer using an app to answer questions during class. The findings on increased engagement because of m-learning suggest that with mobile technologies, the classroom will no longer be a prohibitive space for innovation and technology engagement and thus teaching and learning will be transformed from traditional approaches to unconventional methods of knowledge transfer (Spangler, Rodi and Kiernan 2016; Herro, Kiger and Owens 2013). It is not surprising that students find the m-learning mode of teaching/learning more engaging. Most of these students use mobile devices for social interaction already and these may be useful instruments for academic research. In addition to what was reported by students in this study there are a variety of ways of transferring knowledge via m-learning which foster engagement such as mobile gaming based learning (Facer et al. 2004; Giannakas et al. 2018). M-learning ushers a variety of ways to acquire knowledge, making the learning more dynamic and more interesting for students. M-learning caters for the diverse students such that even the shy students who ordinarily would not participate in class have an opportunity to do so behind screens.

5.3.5.3 Increased access

Most tertiary students in Zimbabwe are of the view that m-learning increases access. This is in the form of quick access to a variety of academic resources and increased communication. There were suggestions that m-learning translated to resources being a "*click*" away and that it was easy to contact someone if one had an academic problem. According to the students m-learning offers a wide variety of learning resources such as YouTube videos, which increase the chances of understanding. Students pointed out that m-learning removed the reliance of learning from the instructor only but extended sources of knowledge to peers and larger communities found on forums. Some of the students focussed on increased collaboration particularly when working on projects (Swanson 2018; Sarrab et al. 2018). Some students felt that m-learning increased student-to-student interaction from which students gained more understanding. Other students discussed how m-learning facilitated easier communication between them and their lecturers. The findings of this study are consistent with those of other studies that indicate that m-learning gives access to increased access to other people and other resources (Koole 2009; Asiimwe and Grönlund 2015; Osang, Ngole and Tsuma 2013; Valk, Rashid and Elder 2010). It may be concluded that the use of mobile technologies with Internet access will improve access to a wide range of educational resources. Access to resources is fundamental to learning, and m-learning opens up a wide range of resources which would otherwise be inaccessible in most developing countries. Participants' comments on increased access are shown in Table 5.6.

Table 5. 6 Participants' comments on increased access

Participants	Remarks
FG_Member2	*"I think it's the fast way of learning. Information is very closer to you when you've got a mobile phone unlike going to the library to research. It will take time, unlike when you have a phone you click once."*
FG_Member5	*"It makes work easier in that if you have a problem you an easily contact someone for a solution."*
FG_Member9	○ *"I would say YouTube has really helped me a lot to cover that gap from tutorials."* ○ *"So when I was doing my attachment, my supervisor didn't tell me the scope of what I was to do but rather I went online and searched what could guide on what I was supposed to do."*
FG_Member11	○ *"I think using mobile devices it's easier to get in contact with someone. I think with issues concerning an assignment or a project, I think it's always easily done when you ask someone who has expert experiences."* ○ *"For example, we did design projects. So you could be facing a problem that someone already faced and solved. So I think you can easily solve that problem when you collaborate with that person."* ○ *"Without the mobile learning experience, you'll have to try and meet the person face to face to communicate. But with the mobile devices you can easily ask that person through the social media platforms we spoke about. It's now easily done with mobile devices."*
FG_Member12	○ *"I think not only looking at the peers around you, I think on the internet having forums would be helpful."* ○ *"You have large groups of people especially those in your field, so you ask a question to people and there is room for discussion."* ○ *"There will be a large community of people you can get help from, as opposed to traditional way where you only have the people around you to ask those questions. So you get help from a larger community around the world."*
FG_Member15	○ *"As a collaborated method of learning which allows us to interact with other students gaining other information that the lecturer might not have been able to provide in class. So it's easier for me to understand other concepts that are not spoken about in class."* ○ *"And there are also other learning resources that you can find on the internet, to understand difficult concepts, which the lecturer cannot elaborate."*
FG_Member18	*"Also the responses are pretty quick, I don't have to worry if I don't understand. If I don't understand something I don't have to worry that the lecturer will take his time getting back to me but it's a matter of minutes and he will get back to me. I can easily understand."*

5.3.5.4 Comparison Increased access vs acceptance of m-learning

The students who are eager to embrace m-learning and also shared thoughts on increased access, believe that m-learning increased both communication and the flexibility to work and learn. Students pointed out that m-learning gave access to other sources of information apart from the instructor. Other students reported that access to information was available all day long, which means learning is no longer limited to specific times. Some students argued that m-learning enabled increased collaboration among students, making it easier for students to understand further. There seems to be a keen interest among Zimbabwean students to learn from their peers and remove the monopoly of knowledge from the instructor. Some students considered other learning resources when using the m-learning mode which made it easier to understand taught concepts. A comparison diagram extracted from NVivo 12 Pro comparing students who are eager to adopt m-learning and also discussed increased access is shown in Figure 5.5.

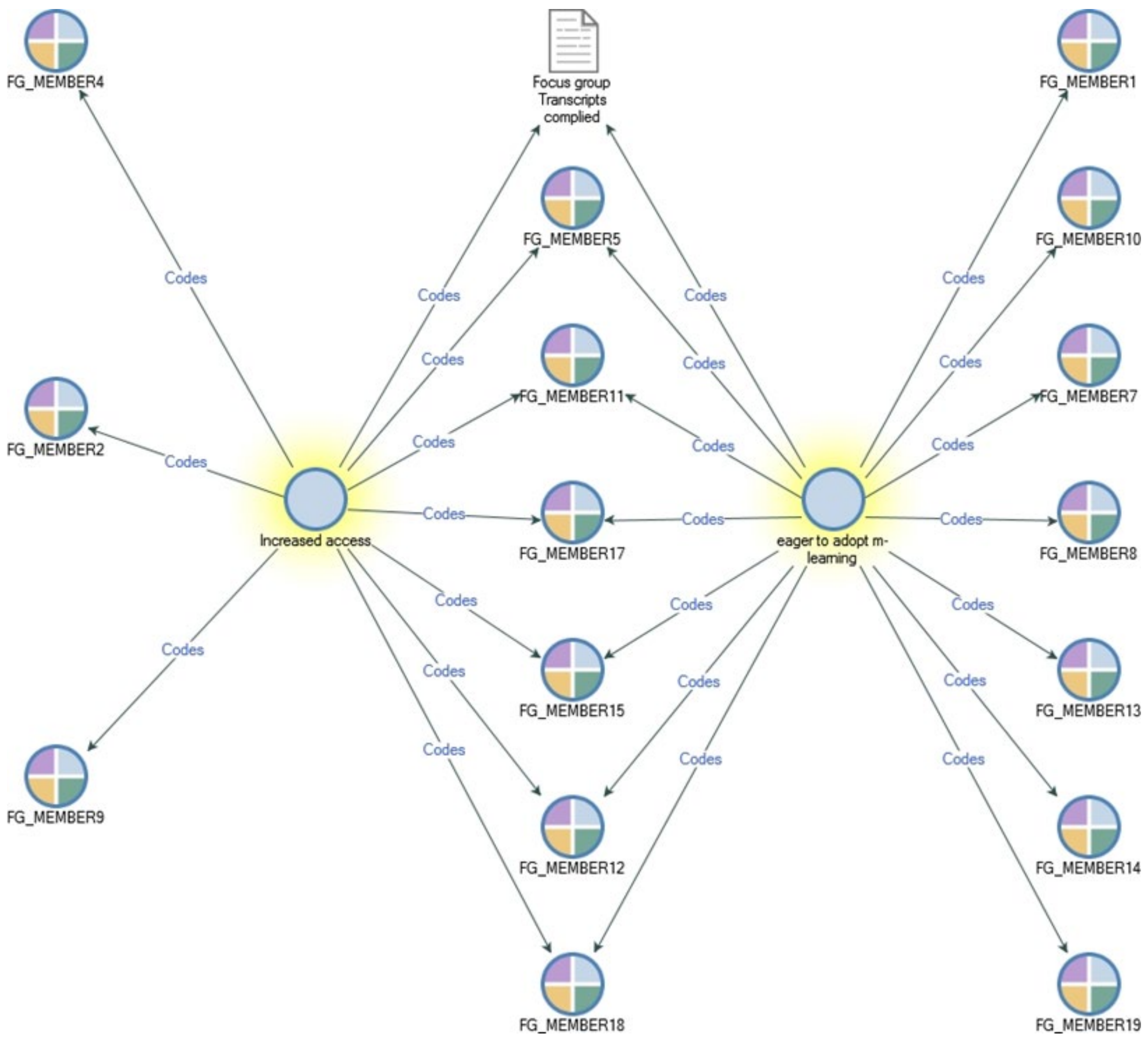


Figure 5. 5 Comparison of increased access vs eagerness to adopt m-learning extracted from NVivo

5.3.5.5 Learning activities using m-learning

According to students, the learning activities available via mobile technologies were both active and passive learning activities. The passive learning activities included recording classes, watching class presentations, accessing course material, checking emails and scheduling dates for assessment submissions (Anshari et al. 2017; Mazana, Montero and Oyelere 2019). The active learning activities included researching for information, looking for video tutorials, answering questions in class using particular apps, developing web applications and use of apps for parts of the unit offered (Sarker et al. 2019; Manuel et al. 2019; Briz-Ponce et al. 2017; Ayub et al. 2017). One student pointed out that m-learning could allow learners to acquire new skills and could be used by learners to develop professionally. Participants' comments on learning activities using m-learning are presented in Table 5. 7.

Table 5. 7 Participants' comments on learning activities using mobile technologies

Participants	Remarks
FG_Member5	*"Accessing documents."*
FG_Member8	➢ *"I think our first vacation in first year we did some IKAE workshop and Dr [name of lecturer], he came with this app called Tolgate which can be used for attendance and it can also be used for answering questions during the lectures. So you just login his domain and you can answer the question and it would appear on the screen (gesturing)."* ➢ *"I think in our own experience, our supervisor and us the students created a WhatsApp group and we use it to schedule dates for assessments and dates for submissions of chapters."*
FG_Member11	*"Yeah I remember when I was doing my project in year 3, I was using this MCP area 345 there was information that I would download and I didn't understand, so I had to ask a guy who had used it before like, "how do you do this and this?." So that's how he helped me to make it easier when I asked him. Cause I just looked on the internet for the person who had used it before."*
FG_Member12	➢ *"I also think the other advantage of mobile learning is that we no longer have the traditional teacher as a source of information only. I think anyone can be a teacher if you understand the concept."* ➢ *"You can do your own tutorial and uhh shoot your own videos and upload them and people can learn from them. Cause students may relate from a fellow student rather than from a teacher because then they're also some tutorials that I actually did and they were actually done by a 13 year old. That's five years younger than me but it actually made it easier coming from him."*
FG_Member17:	*"I can start, so the university that I went to they had a platform called Feeler so it was a student portal. So for the one course I had which was statistics, we didn't have to go for lectures. So the concept was that the lecturer would upload a video and you would do a quiz afterwards and you would submit it and gain feedback."*

5.3.5.6 Flexibility

A benefit of m-learning highlighted by the Zimbabwe students was being able to learn when it best suited them. A number of students who had jobs pointed out that it was difficult to get time out of work to attend classes (Huang and Yu 2019; Shuib, Azizan and Ganapathy 2018). Thus, m-learning would enable them to learn at a time that was convenient to them without having to take time off work. One student argued that bosses at work felt threatened by employees who were attending classes, and therefore made it difficult for them to attend classes. One student suggested that m-learning would ensure that if he were to remain employed and still achieve personal goals, the solution lay in m-learning as this would provide a "win-win" situation. Still on the issue of time, another student pointed out that given that one can access the resources at any given time, learning could occur at his convenience. This student explained that students could access learning content without having to bother the instructor or making an appointment to see the instructor all the time. Besides work, one student stated that m-learning was flexible and could be used to work around students' schedules.

Students are eager to have control of their learning (Bere and Rambe 2016; Montrieux et al. 2015). One student shared his/her experience in which he/she did vacation coursework using videos from Canada and Australia. This student expressed how he was learning during times that were convenient for him, that m-learning was the "way to go". Similarly, another student reported on the learning pace. This student suggested that lecturers in most cases would move at the pace of the whole syllabus or take too long in introducing a concept which could be understood in a shorter space of time, this student preferred m-learning as it enabled students to determine their own pace of learning.

The view on control over learning was echoed by another student, who reported that the main advantage of m-learning was that it was self-based. This student explained that through m-learning he had completed a CISCO unit in which tests and exercises were done at his/her own set time, which enabled this student to adequately prepare for the tests. Another student highlighted the ability to stop and rewind video/audio recordings to get a better understanding of concepts which again speaks to students wanting to take charge of the pace and control of their learning.

One student pointed out that in some institutions, part-time lecturers scheduled classes at times that were not convenient for students such as after hours or weekends, and also that some of these part-time lecturers would be absent for a couple of weeks, which broke continuity. According to this student, m-learning would enable these lecturers to deliver the lecture from wherever making it convenient for students. Another student remarked that on the other hand students did not necessarily have to be physically in class but could access the lecture content from their chosen location. Comments on flexibility are shown in Table 5. 8.

Table 5. 8 Participants' comments on flexibility

Participants	**Remarks**
FG_Member5	*"[as someone already said] in Zimbabwe to ask for time to go to school, it's a threat to our bosses, one way or another. So they have to restrict you to that work place. I would rather take it."*
FG_Member7	*"Taking time off is difficult. So I can be, I can still remain employed and still get, achieve my personal goals. So for me it's a win-win situation so I would go for it."*
FG_Member11	o *"Knowing that you can access the information at any time of the day. So if I wake up and I am busy during the day at 11pm, I can access the video and content without having to bother the lecturer or making an appointment with the lecturer."* o *"M-learning is better, I think lecturers tend to move at the pace of the whole syllabus but when it comes to m-learning, you can move at your own pace. Then you can even move much faster. Sometimes lecturers take a long time introducing a concept they can spend 2 hours on a concept that you could perhaps understand in 10 minutes."*
FG_Member12	o *"I did this during the vacation coursework and it was videos from Canada and Australia. It was 60 hours and I could do it in my own time whenever I was free, I would make time and say at these times I will do this and at the end of the vacation I was done and I got my certificate."* o *"The idea that some lecturers like the part time lecturers will want to come in at 5 and other ones will want to come in during the weekends or maybe the lecturer takes two weeks when they aren't around. So there is no continuity or flow of information. If there is mobile learning knowing that he could deliver the coursework from wherever he is somehow it's convenient."*

FG_Member13	*"I think I would be able to press repeat on the things that I don't understand and I can move forwards or backwards."*
FG_Member16	*"I would say my main advantage was that it was self-based. I could write my exercises and my test at my own time, unlike the exercises that we do in class. So I would have enough time to study and I could write my test afterwards."*
FG_Member17	o *"I think for me it will be availability. So I could download a video and watch it offline. So let's say I come to school right and I'm busy so I know that maybe I'm not understanding a certain concept., during the lecture I can type in a keyword and download that video and then when I get home or on the bus I can watch it again. So for me it's the availability. I don't necessarily have to wait for the teacher to help me. I know that I can get help elsewhere."* o *"So I found it very useful, I actually preferred it than the physical classes. Maybe I could wake up later and I can still watch, I can still go to class but it doesn't mean I have physically attended the class."*
FG_Member19	*"I think its main advantage is that you don't actually have to be there (physically). As in you don't have to be there where the class is, that you're taking. Yeah, so you can do it wherever you are."*

5.3.6 Theme 3: Challenges of m-learning

According to students' comments, the implementation of m-learning in Zimbabwe universities faces three challenges: infrastructure, device issues and affordability (Figure 5. 6).

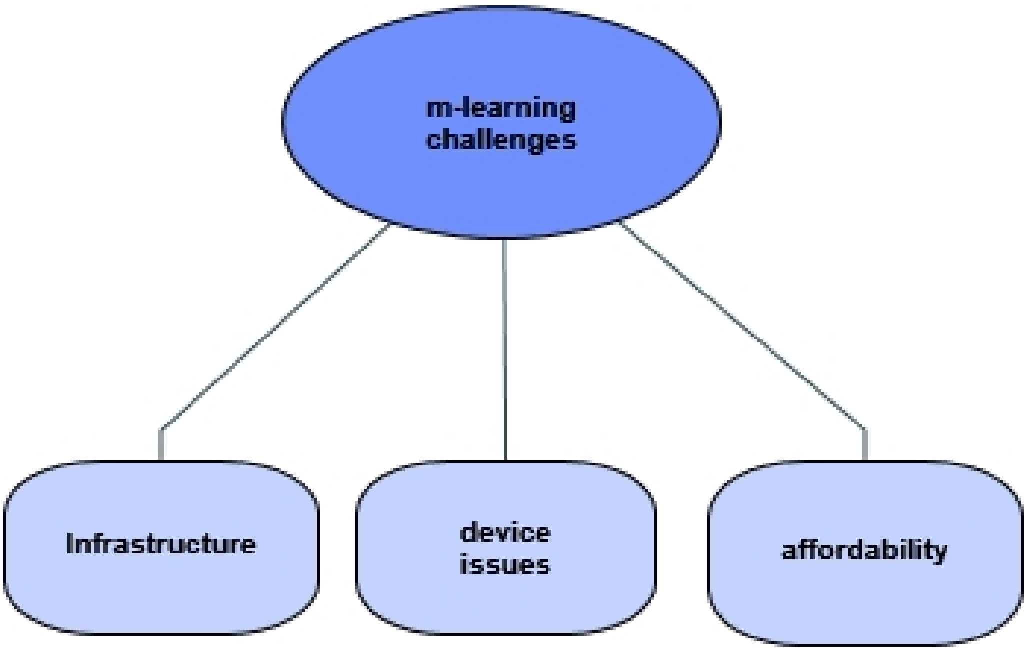


Figure 5. 6 M-learning challenges

5.3.6.1 Infrastructure

Students indicated that there were difficulties accessing the Internet. Poor connectivity was described in various ways. Some students put it as “network issues”, other students talked of poor Wi-Fi, and others mentioned that connectivity was a struggle. One student suggested that there was a need to improve the network infrastructure; another student remarked that bandwidth was an obstacle to m-learning. One student stated that accessing Internet was a problem particularly in remote locations. Unstable power supplies were directly linked to poor connectivity. One student considered how poor electricity supplies also affected the charging of mobile devices. These findings are consistent with infrastructural challenges as a barrier to m-learning discussed in section 2.9.1. Participants’ comments on poor infrastructure are presented in Table 5. 9.

Table 5. 9 Participants' comments related to poor infrastructure

Participants	Remarks
FG_Member3	*"And sometimes when there are power cuts, you won't be able to access the network. The network will be bad. You won't be able to go on the internet."*
FG_Member4	*"Yeah, and I think sometimes problems of the network in some areas, especially in Zimbabwe. Sometimes we don't have to use it."*
FG_Member8	➢ *"Uhh here at our institution, one of the limitations is connectivity."* ➢ *"As in, in terms of the benefits of the service but in terms of connectivity, in most cases it is a struggle. For example in the library or the lecturers department it is still a struggle in terms of Wi-Fi or even bandwidth."*
FG_Member10	*"Yes if we are to go for mobile learning, I think we need to improve the network infrastructure."*
FG_Member11	*"Uhm with power cuts"*
FG_Member15	*"I also think that accessibility of the internet can be a problem, especially for people in the remote areas. They may also have the desire to partake in mobile learning but due to the limitations of the accessibility of the internet they can't."*
FG_Member17	*"I think another limitation would be bandwidth."*
FG_Member18	*"Sometimes the charging of devices can be a problem."*

5.3.6.2 Device issues

Learners in Zimbabwe raised concerns regarding unsuitable devices and some inherent characteristics of mobile devices. There are various issues related to mobile devices as shown in the participants' comments presented in Table 5. 10. Students believe that these concerns could affect m-learning adoption by students in Zimbabwe universities.

Table 5. 10 Device issues

Charging of mobile devices ➢ One learner described the mobile devices some learners had as "refrigerators" that constantly needed to be plugged to a power source. ➢ Some learners argued that some mobile devices take up more battery power and require frequent recharging. ➢ Similarly, another learner noted the need to have a reliable phone that did not quickly die out or run out of battery as this would be problematic when accessing the Internet. The limited battery power of mobile technologies as a constraint to m-learning has been discussed by (Mehdipour and Zerehkafi 2013; Oyelere et al. 2016). The issue of mobile devices constantly needing to be recharged can be a hindrance to m-learning, further exacerbated by intermittent power supplies.
Mobile phones not suitable for learning ➢ A learner commented that a mobile phone was not user-friendly for learning but preferred to use a mobile phone to access social platforms such as Facebook and WhatsApp. ➢ Another learner, emphasising how a mobile phone may not be suitable for learning, explained that in one of the units a lecturer had sent a practical assignment which they could not read properly on the phone possibly because the lecturers took a photo of the documents. It is possible that if the document had been sent in the correct format, the student would find it easier to read the document. ➢ Similarly, another learner suggested that mobile phones were for learning life skills such as cooking, and not for educational "stuff". ➢ Another learner commented that it was easier to work on a laptop than on a mobile phone. Some learners remarked that mobile devices could "freeze" or crash when browsing, and sometimes there would be no backup. These findings confirm that some students would prefer using PCs rather than mobile devices as previously discussed in section 2.11.2. In a review conducted by Frohberg, Göth, and Schwabe (2009), when studies on m-learning were much fewer and did not focus on higher education (before end of 2007) these researchers observed that mobile phones were primarily used as communication tools and that social interaction played a small role in m-learning

projects. There has since been a sharp increase of studies on m-learning as observed in subsequent reviews (Hwang and Tsai 2011; Wu et al. 2012). There is a suggestion that earlier projects focussed on content dissemination instead of social interaction between tutors, teachers or peers using mobile technologies (Arrigo et al. 2013). It is possible that some learners in Zimbabwe may also be focussing on content dissemination and neglecting the social interactions with peers and instructors as important aspects of m-learning.
Processing power ➢ Students in Zimbabwe universities also considered some problems intrinsic to mobile devices. One student argued that some mobile phones did not have sufficient processing power which would be an obstacle to m-learning, this has also been acknowledged in previous studies (Al-Arabiat, Ahmad and Sarlan 2015; Wang, Wu and Wang 2009; Sarrab, Elbasir and Alnaeli 2016). ➢ In a study using mobile devices in textile, clothing and design programmes at a tertiary institution in Zimbabwe (Dzikite 2017), it was observed that only a few students had suitable mobile devices with processing power to access a specific useful fashion design application. Tertiary institutions should provide access to suitable mobile devices, with high processing power so that students may access the resources required for their learning (Dzikite 2017). It may be concluded that given that different mobile technologies have different processing capacities, it is important to ascertain the minimum requirements for suitable mobile technologies that can be used for m-learning and also consider how students can access these technologies.
Limited functionality ➢ Some students pointed out that some mobile devices owned by students did not have many features; i.e. they cannot play videos or support other formats such as PDFs. These findings are aligned with those of earlier studies by Pimmer et al. (2013), with postgraduate students. In this study, by Pimmer et al. (2013) it was observed that students using mobile devices with voice, pictures and annotated images obtained a better learning experience than did those learners who had devices that transmitted only voice or pictures.

- On the other hand, Farley et al. (2015) assert that many universities fail to take into account that students are using smartphones and tablet to support their learning, which could suggest that in some tertiary institutions, learners have suitable mobile devices for learning.

Based on the findings of this study and previous studies it may be suggested that in the contexts where m-learning is taking off, access and affordability of suitable mobile technologies will not be homogeneous and will therefore have important implications for the large-scale implementation of an e-learning model.

There is a diversity of challenges related to mobile technologies in the Zimbabwean context. Some of the issues are a result of unsuitable devices, although some learners may feel mobile phones are not suitable for learning, the social interactions with peers and instructors go a long way in providing effective teaching and learning. These findings raise interesting questions regarding the extent to which learners would be willing/unwilling to use mobile phones for learning. Participants' comments on device issues are presented in Table 5. 11.

Table 5. 11 Participants' comments related to device issues

Participants	Remarks
FG_Member1	*"The other problem is that it may not support certain formats; the opening of certain formats for example pdfs. You can have difficulties accessing such information. And that is the majority of phones that we have as students. They don't support these formats."* *"I think when you use mobile phones you mainly learn about maybe life skills not educational stuff. Like when you want to cook something, or you want to wash something or when you want to do something that does not require sitting for an example or studying."*
FG_Member3	*"For example in our group, one of our lecturers sent a practical assignment but you could not properly read it on the phone. Probably he took a picture to send the document so on the phone you could not properly see it on the phone."*
FG_Member5	*"Accessing documents, it (document) can get mixed up with other social documents, to access what you want becomes tedious."*
FG_Member6	*"I think it's the...the first one has to do with the power of the phone. Yes, processing. It's much easier to browse the internet using a rod core i5."*
FG_Member7	*"If it [mobile device] crashes you lose everything. You might not have that conscience of getting a backup unlike when you have that information stored on your laptop?"*
FG_Member10	*"In terms of our mobile devices, it's easier to work on the laptop than it is to work on the phone. Most of them depend on power, so without any power, they are useless. At school the power is good but at home it is problematic. Although load shedding has improved power is still a problem."*
FG_Member11	*"Uhh most machines are refrigerators need to be constantly plugged to power supply."*
FG_Member13	*"The greater part of the people, they do have devices but we still have a number of others that don't ..."*
FG_Member18	*"Because since you're reading online, some of the mobile phones, tend to take up more battery than others so especially with laptops and even with mobile devices. This is something that we know already and we need to keep recharging it every now and again. So that can be a limitation. Sometimes the charging of devices can be a problem."*
FG_Member19	*"Yeah, I think the issue of the type of device that you're going to be using to access those files. If you check, ehh, like what we are doing right now, when we are writing our exams like CISCO, there are some other questions that require us to use Java but yet you see that on some other machines it can't run, so therefore it won't open. So it goes back to the type of device that you're using."*
FG_Member20	*"Yeah, sometimes you may require a very expensive device and one of the challenges you may find is time spent trying to zoom in because the fonts are very small. So you may end up spending more time trying to zoom in than actually doing your work."*

5.3.6.3 Affordability

Some students argued that a challenge to m-learning was affordability. Affordability as discussed by the students is two-fold (1) of cost of devices and (2) cost of Internet access as shown in Table 5.12. Some students while eager to integrate technology with education indicated that not all students had access to suitable mobile devices for this purpose.

Table 5. 12 Affordability challenges

Cost of devices

- One student clearly stated that even if students wanted to incorporate technology in their learning, some students did not have the finances to buy mobile devices.
- To put into context the cost of devices, one student explained that while the average salaries were between $350-400, basic smartphones cost $200.
- Another student argued that the cost of refurbished iPhones was approximately $800 adding that this was only for the rich.
- In the same vein other students remarked that sometimes one would require a sophisticated device to accomplish particular tasks and such mobile devices were out of reach for most students.
- Another student pointed out that there was a huge gap between a basic mobile phone and a smartphone, and that to have suitable apps on the mobile devices requires advanced mobile devices which are expensive.
- One student argued that because of the different financial capacities across students the introduction of m-learning would disadvantage students who could not access the mobile devices thus it would not be inclusive which could increase a digital divide.
- There was a suggestion by one student that the issue of affordability of devices could be addressed by offering devices at a discounted rate for students, as had been done by one mobile service provider [Econet] previously.

These findings are consistent with previous studies in Nigeria and Tanzania that showed that while mobile phones are affordable, the mobile phones appropriate for m-learning were unaffordable for some students (Oyelere et al. 2016; Mothobi and Moshi 2017). The findings of this study on the other hand are contrary to those found in other parts of the world such as Australia, Brunei and Lebanon (Farley et al. 2015; Anshari et al. 2017; Poushter, Bishop and Chwe 2018). Poushter, Bishop, and Chwe (2018) have demonstrated that smartphones are becoming increasingly common around the globe, with people in wealthier countries exhibiting higher rates of smartphone ownership.

In resource-constrained contexts where m-learning interventions focus on equity, an access and affordability spectrum should be included (Roberts and Spencer-Smith 2019). Although smartphone ownership is constantly rising, individual income is significant as this may determine whether or not one owns a smartphone. The implementation and adoption of m-learning may be more successful if considerations are made on accessibility and affordability of mobile technologies for the students.

Cost of Internet access

- Most students indicated that access to Internet is expensive.
- One student argued that Zimbabwe probably had the most expensive data in the world. Students are very conscious of the cost of using mobile devices to access Internet.
- One learner explained that when accessing video content on mobile devices, one required more bundles. However, the price of the data bundles in Zimbabwe made it difficult to access Internet.
- Another learner pointed out that when working from home, cost was a significant consideration.
- One learner suggested that for m-learning to be successful, institutions should grant learners free data access.
- Another student suggested that the government should subsidise Internet access costs for students.

The cost of Internet access in low and some mid-income countries relative to average income, is over 100 times the cost of a comparable service in high-income countries, making it very challenging for learners to obtain connectivity in the low and mid-income countries (Brown and Mbati 2015; Churchill, Pegrum and Churchill 2018).

It is likely that while students have free access to the Internet via the institution portals, the challenge arises when they leave campus and have to pay for their own Internet access. This creates discontinuity as they cannot afford Internet access. In many advanced economies, more than 70% adults have access to Internet (e.g. South Korea, Netherlands, Australia, Sweden and Canada) and conversely below 70% adults in 13 developing countries (e.g. India and Tanzania) have no access to the Internet ((Poushter, Bishop and Chwe 2018, 11).

It is evident that some, but not all, students have mobile devices. Although students have access to mobile devices, it is important to establish whether these mobile devices are suitable for learning. The lack of standardisation may make m-learning implementation and adoption more challenging. These findings have significant implications for the development and implementation of an m-learning model in Zimbabwe's tertiary institutions. Participants' comments on accessibility and affordability are shown in Table 5.13.

Table 5. 13 Participants' comments related to the accessibility and affordability of mobile technologies

Participants	**Remarks**
FG_Member5	*"Yeah like what Econet [mobile service provider] did. They gave students these mobile devices at an affordable rate."*
FG_Member7	*"Yes it [data] is expensive."*
FG_Member8	*I think before they implement the mobile learning they should concentrate on making sure that the resources are available in terms of the laptops in the libraries because it's not everyone who has a laptop or a smartphone.*
FG_Member10	*"Oh like if I'm working from home, I have to look at the costs. This is because data is expensive."*
FG_Member12	*"I think when you look at Zimbabwe generally data is expensive. So when you want to access video content, you need to pay a lot more because it takes up more data and with our bundles that we have it will not sustain you much cause of the price. If it were inexpensive it would not be a problem but with the price that we have here in Zimbabwe it becomes a little difficult to access Internet."*
FG_Member13	*"The greater part of the people, they do have devices but we still have a number of others that don't ..."*
FG_Member17	➢ *"The fact that it [bandwidth] is not easily affordable, especially here in Zimbabwe because I think we might even have the most expensive data in the world. So even if I want to watch the video, if it's on my phone I have to think if I have enough bundles to watch it."* ➢ *"Well if it's a basic smartphone then I'm looking at $200 going up. So now like with apps, like CISCO has an app, I'm more likely to use the app than to go on the browser and then log in and then get the pages. So then I'm looking at a device that also has memory capacity for an app versus a small basic phone which is about $9/10 dollars. So the gap between that and the average smartphone is very big."*
FG_Member18	➢ *"And uh, I think another thing is that someone may want to learn via technology but the affordability we don't have the resources to buy the phone, we might not have the finances."* ➢ *"Yeah it's not easily affordable because uhm, the type of device you want in respect to the programs you want it to be running; you find that the ones that can access the programs are on the expensive side."*
FG_Member20	*"Yeah, sometimes you may require a very expensive device and one of the challenges you may find is time spent trying to zoom in because the fonts are very small."*

5.3.7. Theme 4: Pedagogy

Pedagogy may be defined as the method and practice of teaching. Students raised three pedagogical issues with respect to m-learning: challenges for learners, challenges for instructors and challenges with the m-learning mode, as shown in Figure 5. 7.

Figure 5. 7 Pedagogy

5.3.7.1 Challenges for learners

In relation to pedagogy, students highlighted three main challenges for learners, namely distractions, the huge transition from traditional methods of teaching and learning, and the need for face-to-face interactions.

Distraction

Some learners, while supportive of m-learning, indicated that m-learning could distract them from their academic endeavours. Distractions included notifications on social platforms, incoming phone calls, and incoming messages. Some learners reported that the incoming calls and messages would sometimes require immediate attention, forcing learners to abandon their learning to attend to other issues. There was a suggestion that some learners share phones with other family members, and at times other family members would want to use the mobile device which means learners lost focus on what they were doing.

One learner, sharing a personal experience, reported that videos on platforms such as YouTube that are not dedicated to learning material, made it easy to become distracted as the platform has extensive content that may be quite different from what one was initially seeking. This learner suggested that distractions could be reduced by selecting platforms that were specific to what one wants to learn, such as EdX. Another student agreed, adding that when watching videos on platforms that had wide-ranging content, it was easy to get distracted when content related to celebrities or something of interest popped up. New tabs opening up with things of interest and advertisements that were non-academic were also reported as a major distraction when online. A study by Berry and Westfall (2015) showed that over 60% of students in two universities in the US checked their mobile phones at least three times during an average class. In a study of Iranian university students, some learners reported that "entertaining m-learning features" were a distraction (Delialioğlu and Alioon 2016). In contrast, some students found games to be more engaging in studies by (Liu and Chu 2010). In a lengthy essay on medium Shirky (2014) explains that he asked his students to put away mobile devices because the devices were a major distraction. Multitasking of checking the phone during class has been demonstrated to affect learning and information retention in university students (Ellis, Daniels and Jauregui 2010; Kraushaar and Novak 2010; Fox, Rosen and Crawford 2009).

According to Pedro, de Oliveira Barbosa, and das Neves Santos (2018), the use of mobile devices in the education contexts points in two different directions: (1) the struggle to retain student interest and attention while still connected to the outside world using mobile devices with considerations that use of digital devices and a non-restrictive policy on use contributed to poorer retention of classroom material; and (2) a traditional classroom with a teacher and a mobile device can be used effectively to promote collaboration and enhance the learning environment. These researchers further argue that while some would consider the two perspectives are compatible or not mutually exclusive, the reality is not so positive. The challenge therefore remains to find the right balance whereby learners remain connected to the outside using mobile technologies and actually benefit academically and enrich their educational journey using these mobile technologies. Participants' comments related to distractions when using mobile technologies are presented in Table 5. 14.

Table 5. 14 Comments related to distractions

Participants	**Remarks**
FG_Member1	*"You can be distracted maybe in the home set up? Families [they] want to phone or access something on the phone. It wastes time."*
FG_Member2	*"And if you hear about certain videos, viral videos. You always switch to that. You will always want to see."*
FG_Member3	○ *"Yes, I can be ready to use my phone but those distractions we were talking about. Probably you're going to receive an emergency message there so you're going to check on it, you get distracted, probably you have to reply a number of people but at the same time you are supposed to concentrate, so it will vary with the situation that you are in."* ○ *"Sometimes, yes, I can actually work with a phone."*
FG_Member7	○ *"The issue of discipline yes, it's very distractive because once you get a an emergency like what someone has said, you're then forced to forgo what you were studying and then attend to that business.* ○ *"I would say the same thing when it comes to discipline. With a phone, distraction is quite high because uhm one moment you'll be trying to study like what you were saying when you went for your course and the next thing you want to know what's the update, what's going on around."* ○ *"Yes notifications will be coming in."*
FG_Member12	○ *"Yeah with distractions, I won't lie, there are a lot I have experienced it but I also think that if your main focus is on one format, for example video tutorials and if you go on YouTube, you are bound to get distracted because it has different content."* ○ *"But then you also have other platforms that are really specific to the materials that you have for instance if you go on Edex they have different course materials that they have and you're only going to see video tutorials related to the learning materials. So the distractions are kind of less with other platforms as compared to other platforms."*
FG_Member15	*"Then I think that another limitation is distractions. Let's say that I'm trying to access notes on YouTube and then a video comes up about something about a celebrity or whatever, I can easily be distracted and focus on other things that have nothing to do with school."*
FG_Member19	*"I think uh, like especially when you're trying to do your work and then a new tab opens up and it's a tab for EBay and then you may see something that you have always wanted actually being advertised. I think if maybe on the internet, if they could put less ads, I think maybe it would be better."*

Huge transition in mode of learning

One learner argued that after many decades and decades of students having an instructor in front of them, introducing m-learning would not be easy. This learner explained that while m-learning was modern, this would be sudden and that such a change would be a "*big ask"* for the students. Another student in agreement suggested that m-learning should be introduced in secondary schools as people do not radically change overnight to create early exposure to m-learning.

One student reported that this mode of learning would call for a more disciplined approach to learning. This student discussed that m-learning offered more flexibility in learning compared to the traditional approach. According to this student this flexibility could lead to procrastination whereas the traditional approach compelled students to be more on task. Another student added that m-learning required discipline for self-learning. This could be challenging for learners who have not previously done this.

Earlier studies on m-learning reviewed by Wang et al. (2009) suggested that m-learning merely pushed content to students. It is likely that learners in Zimbabwe consider this aspect of m-learning, which is why they would consider it a big transition, seen as a mode that replaces instructors. Some undergraduate students in Canada suggested the use of mobile devices as supplementary tools and not as primary learning tools Wardley, Carter, and D'Antonio (2018). Similarly, secondary school students in the UK used iPads to seek help and support from peers and to access Internet resources (Li 2018). It may be necessary to make learners appreciate that the m-learning system can be considered as part of blended learning as suggested by (Ozdamli and Cavus 2011; Ramsay and Terras 2017; Swanson 2018). M-learning now looks beyond just pushing content but also into student-student interactions as well as student-instructor interactions, peer collaboration and more engagement with learning materials. M-learning should not be seen as a replacement for instructors but rather as a supplementary educational tool, which can be incorporated with the traditional face-to-face interactions with instructors.

Need for face-to-face interaction with instructor

One learner shared her frustration with m-learning based on past experience when working on a project with her supervisor who did not respond promptly, taking as long as three weeks to provide feedback on the project, and doing so only after the student had called him. It is evident that while the idea of m-learning is for learning to occur anytime and anywhere, this was not the case for this learner. This learner believed that being physically present in the same location with the supervisor would have yielded instant responses; in this instance, the use of technology was not convenient. Another learner added that when students actually attended classes, the lecturer would give hints about important things such as the types of questions to expect on an exam. This learner was concerned that m-learning would mean that students would have to read and know everything without assistance from the lecturer. Another learner expressed that it was easier to remember what one has been taught in person.

There was a suggestion that learning that occurred in the same physical location could be understood better and remembered more than via m-learning. Some students are concerned about whether they will be able to grasp the concepts taught using m-learning mode. One learner argued that some learners struggle to grasp concepts and an instructor can explain in various ways until the learner understands. This learner, while acknowledging that with audio/video recordings one can replay the lessons, the recordings may not make learners understand the concepts in the same way as an instructor could. Another learner echoing the same sentiments was not sure whether she would be able to understand all the concepts when using m-learning.

In a study of students in Malaysia, it was observed that some learners were not keen on m-learning and preferred the traditional method of face-to-face interactions with the instructor Suki and Suki (2011b). Similar to learners in Zimbabwe, the Malaysian learners mentioned that face-to-face interactions were useful with tough subject matter and the best guides for learning. In a review of technology-enhanced learning in developing countries, it was noted that even though new technology has opened up avenues to the world market, traditional approaches such as printed material and radio remain more effective and more accessible to the greater population Gulati (2008). Gulati (2008), however, concludes that this does not suggest that developing countries should stop integrating technology with education; rather, it recommends holistic policies that acknowledge the challenges. A blended approach that integrates technology with traditional approaches may be a better option as learners still have face-to-face interactions with instructors and can access additional resources and extend their learning through social interactions and collaborations.

5.3.7.2 Challenges for instructors

A challenge reported by some learners regarding instructors was that not all instructors were ready to embrace m-learning. There are suggestions that lecturers need to be well trained so that they can be more effective. Some learners preferred instructors to embrace social platforms such WhatsApp and other instant tools for communicating with learners and not just resort to email. It is possible that learners would prefer that instructors use social media platforms as learners can buy data bundles for social media platforms only.

In an earlier study conducted in Malaysia, just over half the lecturers relied on mobile technologies for assessing and delivering teaching material (Suki and Suki 2009). In a more recent study in Tanzania, (Mfaume 2019) reported that teachers in Tanzania lacked training and competence to utilise mobile technologies for teaching and learning. It was also suggested in this study that teachers had a negative attitude towards the use of mobile technologies for teaching and learning. In Turkey, some students believed that instructors had inadequate skills for m-learning (Delialioğlu and Alioon 2016). In contrast, professors in Portuguese universities are receptive and believe in the capital gains that can be achieved by using mobile technologies for teaching and learning (Moreira et al. 2017). Instructors need to adopt technology with enthusiasm and realize that a negative attitude and lack of fundamental skills required to use the technology to support learning would have serious disadvantages (Wardley, Carter and D'Antonio 2018). It may be necessary to provide training and resources for instructors to in order to boost confidence and motivation to use mobile technologies for teaching and learning. It is highly likely that if instructors show enthusiasm for using mobile technologies for teaching and learning, this would have many advantages in terms of the large-scale adoption and implementation of m-learning.

5.3.7.3 Challenges with m-learning mode

Challenges with the m-learning mode were discussed in terms of the quality of learning, inequality, and inclusivity and how the mode was poorly regarded.

Reduced quality of learning

There were suggestions that m-learning had the potential to produce learners who would behave without academic integrity. One student suggested that some learners might ask other people to do assignments for them, and will submit these as their own work, which means such learners could actually obtain qualifications fraudulently. Literature has documented concerns about the use of mobile technologies. These include decreasing the quality of learning as these devices open opportunities for plagiarism, cheating and procrastination (Gong and Wallace 2012; Muhammad et al. 2016; Banyard, Underwood and Twiner 2006). Consistent with the theme of reduced quality of learning, a study by Trushell, Byrne, and Simpson (2012, 4) showed that 45% of learners reported engaging in “cheating behaviours” when using ICT for learning. When integrating ICT with education, it may be important to educate learners on the ethical consequences of their behaviour. This may include having effective academic integrity policies coupled with raising awareness of these policies. Cheating behaviours are a well-established educational problem, and new technologies may exacerbate this problem. It may be crucial to ensure that instructors are highly ICT-literate or have specific measures in place to circumvent the issue of cheating.

Inequality and inclusivity

One student suggested that because of the different financial capabilities of learners, not all learners would have access to mobile devices to use for m-learning. This learner considered the lack of inclusivity if nothing was put in place to ensure all learners had access to the required mobile devices (Welsh et al. 2018). This student indicated that it was essential to carefully think about people’s financial constraints, and wondered about the implications for those learners who could not afford the required devices.

It is highly likely that at this point, m-learning would be implemented following the Bring Your Own Device (BYOD) concept and this highlights the challenges of BYOD. BYOD is the idea that an individual makes use of their own personal technological device in a workplace or educational institution rather than using an institution-owned device. The ubiquity of mobile phones and tablets has been observed to be a factor for m-learning adoption (section 2.8.1.2). However, studies in UK universities showed that students thought that the BYOD concept produced inequality and the lack of inclusivity (Welsh et al. 2018; Welsh et al. 2015). Although mobile technologies continue to increase and become accessible to many, not all learners have access to suitable devices; hence, learners will be excluded from those learning activities that require the use of the mobile devices, raising issues of inequality.

Poorly regarded

Some learners are skeptical about the type of learning acquired using the m-learning mode. One student indicated that people in Zimbabwe tend to look down on other modes of learning that are not the traditional face-to-face mode. Some learners concurred, adding that in Zimbabwe studies undertaken in a non-traditional manner were not highly regarded; however, these learners were not clear on why this was the case with suggestions that it could be just a stereotype. One suggestion as to why Zimbabweans shun alternative modes of learning like m-learning was that some people questioned the credibility of programs using such modes; however, other learners argued that credibility of courses done via m-learning depended on the awarding institution. There was also a suggestion that courses done using such modes of learning did not have a competitive edge in the job market.

The main reasons for questioning the validity of certificates obtained through Massive Open Online Courses (MOOCS) were the issues of cheating and plagiarism (Tsoni and Lionarakis 2014). One challenge of integrating technology with education observed in China and Korea earlier on was that the problem with Internet-based learning was the lack of credibility of online degrees (Motlik 2008). While the perception of online qualifications may have now changed in some countries, it is evident that in some places Internet-based learning may still not be highly regarded. In some communities particularly in the developed countries m-learning is gaining more ground and being embraced by learners. The results of a study to compare two modalities of learning (1) a traditional method based on a teacher's speech vs (2) a simulator experience based on the use of mobile technologies suggested that learners performed better using the app as a supportive tool compared to the traditional method (Briz-Ponce et al. 2016). The challenge now is to raise awareness of how mobile technologies can be used to extend learning and ensure that qualifications obtained by learners are valid and acceptable. Use of mobile technologies can be used as supplementary tools to the traditional approach which reassures learners on the credibility of their qualifications. Participants' comments relating to the challenges posed by m-learning are presented in Table 5.15.

Table 5. 15 Comments related to challenges with the m-learning mode

Participants	Remarks
FG_Member2	➢ *"I won't take it because like, someone was saying the credibility of the program will be doubted. You know there are some guys who are studying through ZOL and they are looked down upon by the society. And even the competitive edge in the job market, you won't have."* ➢ *"You can easily remember what you have seen or what you have been taught in person."* ➢ *"But I think it depends on the institution for example if you look at our institution. But if you look at some mushrooming online university it becomes tricky scenario."*
FG_Member4	➢ *"Hmm ah, I wouldn't. Ah because I think mobile learning sometimes is hard. Uhm, I had an experience for my project. I would send my supervisor my project, he would take about three weeks to respond. All the time I would be waiting, stuck, waiting for his response. Then I would have to call him. So, for me I think mobile learning is frustrating"* ➢ *"Plus, something learnt in physical is easier to stick to the head than something you're told "just do it this way" than the physical presence of each other."*
FG_Member5	*"I think about people who earn the certificates that they have not fully studied for, what if someone writes the assignment for them, someone may only contribute only 10%, I think that they get them for what they have not studied for."*
FG_Member6	➢ *"I would not be interested. Maybe it's just a type of view or stereotype, where people often look down upon courses that are taught in such a manner- distance learning."* ➢ *"Especially here in Zimbabwe. They just look down upon those courses. I don't know the reason or what"*

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Comparison of distractions vs acceptance

Learners in Zimbabwe are quite aware of how m-learning can be a distraction to their academic work. A closer inspection was done of the focus group discussion to analyse if distraction would be a factor in acceptance of m-learning. The comparison diagram feature of NVivo 12 Pro was utilised. It was noted that three participants discussed distraction and negative acceptance of m-learning as shown in Figure 5.8. A further analysis of the discussions by the three participants FG_Member1, FG_Member2, and FG_Member4, revealed that FG_Member1 had a host of factors that would lead him/her to not embrace m-learning. FG_Member4 on the other hand was not keen to accept m-learning as he/she preferred physical contact with instructors. FG_Member2 was not keen on taking up the m-learning mode based on the credibility of this mode, preferring the physical contact with an instructor, and was not keen on using mobile devices for learning. Although distractions seem to be quite a challenge for m-learning, they do not seem to be a factor that will deter tertiary students from embracing this mode of learning.

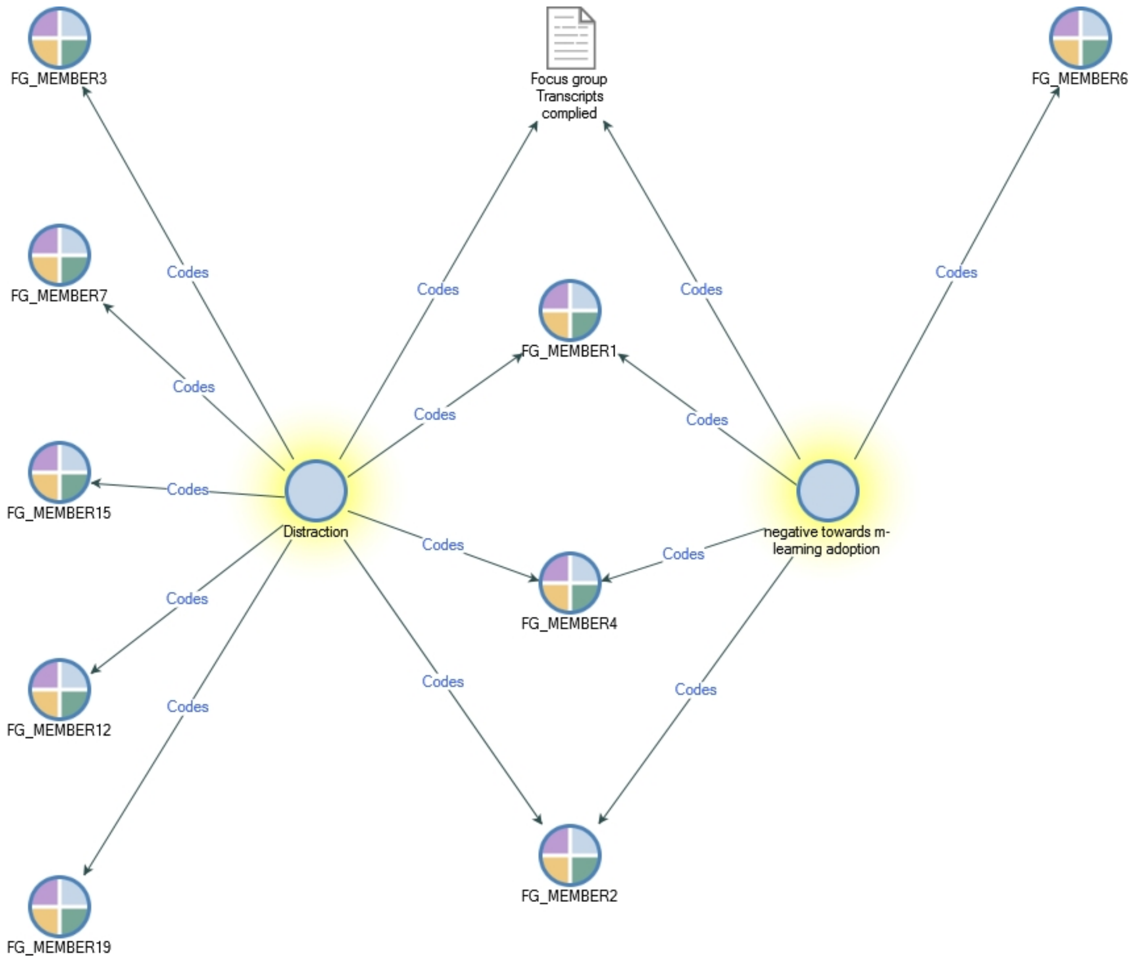


Figure 5. 8 Comparison distraction vs negative attitude towards m-learning

5.3.8: Theme 5: M-learning acceptance

M-learning acceptance by learners appears to hinge on four main aspects (Figure 5. 9) namely (1) m-learning characteristics, (2) experience with m-learning, (3) willingness to embrace m-learning and (4) readiness to adopt m-learning.

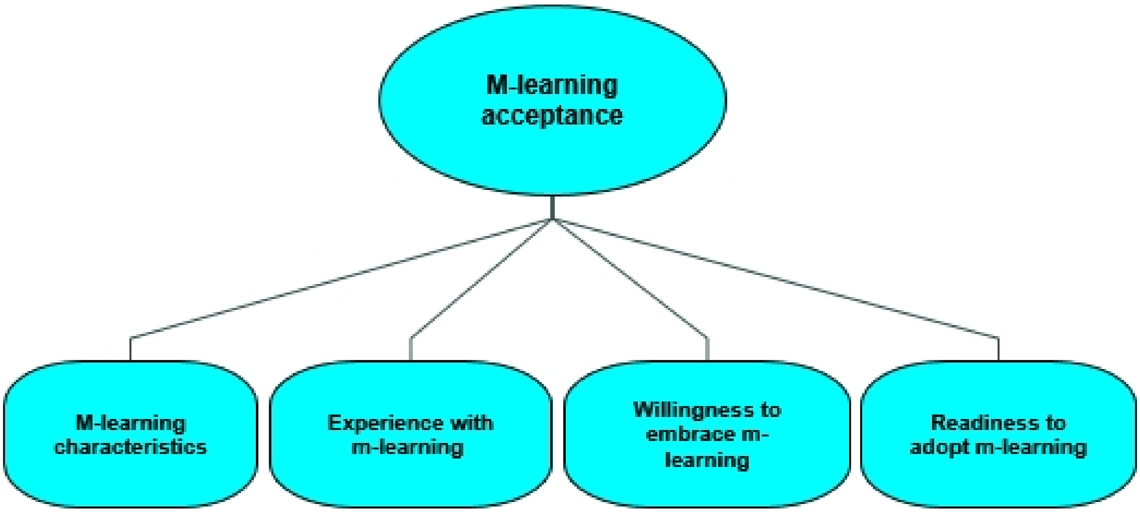


Figure 5. 9 M-learning acceptance and sub-themes

5.3.7.4 M-learning characteristics

As discussed earlier, some advantages of m-learning emerging from the focus groups include its ability to provide convenience, increased engagement, increased access and flexibility. Another benefit of m-learning that emerged from the student discussions was self-learning.

Self-learning

Opinions on self-learning differed among participants. Some learners reported that they were not ready to use mobile devices for learning and they required constant support from instructors. Some learners preferred having an instructor in front of them as they felt instructors would provide more relevant information, particularly for exam preparation. One learner argued that a different approach to the learning experience would be required and this called for discipline from learners. This seems to suggest that learners appreciate that they will need to take up more ownership of their learning. On the other hand, some learners suggested that they were no longer depending on instructors only for their learning. One learner reported that m-learning had already been adopted to some extent but that some people just did not realise that. Learners reported that some students were already using other sources of information and not attending classes as they felt the instructor did not deliver the course material to their satisfaction.

In a Taiwan university, the introduction of self-paced learning via mobile devices in language instruction enabled learners to learn in a more autonomous and active manner (Wang 2017). Mobile technologies provide ubiquitous opportunities for learners to carry out inquiry processes in a more self-directed manner (Suárez 2018). The level of self-directed learning with technology affects academic success and technology integration (Gokcearslan 2017). There are suggestions that while m-learning is not yet formally in place in some Zimbabwean universities, some learners are taking it upon themselves to find alternative ways of extending their learning using mobile technologies and thus proving to be self-directed learners. There is a likelihood that with constant use of mobile technologies, some learners will begin to take more charge of their own learning.

5.3.7.5 Experiences with m-learning

There are varying experiences with m-learning that were reported by learners in Zimbabwe. Some learners indicated that it was difficult to access documents on mobile devices, particularly mobile phones. One learner indicated that in one class a lecturer had sent a document for an assignment that was not legible. Another learner reported that documents could easily get mixed up with social documents which made it tedious to find the required item. Another negative experience reported was poor communication with a lecturer, with the student indicating that face-to-face interactions would have produced more instant responses.

Some students reported positive experiences. One learner recalled their experience using an app called *Tolgate*, describing it as useful. The app was used to take attendance and to answer questions in class. Another learner reported using a platform called *Feeler,* the lecturer uploaded videos and quizzes for the learners. The learners would do the quizzes and receive feedback on their performance. The learner described the experience as effective, adding that he particularly liked being able to replay the videos without disrupting the whole class or waiting for the instructor to explain after class. Another learner shared how he did an m-learning course on web development with a lecturer outside of Zimbabwe. This learner's experience was that it took him a shorter time to complete the course given the flexibility of studying at his convenience. It also provided opportunity to collaborate with "unknown" peers. This learner suggested that m-learning could be a mass platform which could benefit learners to develop professionally. Similarly, another learner reported doing vacation coursework using videos from Canada and Australia. This coursework required 60 hours, and the learner liked the flexibility with which he could do the work. Another learner added that he had completed a short course using the m-learning mode, by watching short videos online.

Some learners pointed out that YouTube videos had greatly assisted them to cover any gaps in tutorials and lectures. Another student, when considering the self-based nature of m-learning, shared how she had done a Commercial & Industrial Security Corporation (CISCO) course for which she could take tests at her convenience unlike the traditional classes with set times. The main advantage for this learner was that she had enough time to study and sit the tests when she felt ready.

Some learners have resorted to using m-learning in a bid to find solutions. An example was a learner who felt that his supervisor had not given him sufficient information while on attachment/placement. This learner went online to find information that could guide him. Another learner reported that his/her supervisor created a WhatsApp group to schedule dates for assessments and submissions for projects. One learner commented that he was using m-learning as he could not attend lectures at all. One learner suggested that while power cuts were an inconvenience, students used mobile phones to search for information and then transferred this to laptops.

Learners' experiences with m-learning so far speak to characteristics of m-learning discussed earlier (convenience, increased engagement, increased access, flexibility and self-learning). Learners who have had positive experiences with m-learning are more likely to embrace m-learning and there is a likelihood that the sharing of the positive experiences may positively influence other learners to embrace m-learning.

5.3.7.6 Willingness to embrace m-learning

Acceptance of m-learning by tertiary students in Zimbabwe has three levels. One group has learners who believe m-learning is a good initiative but are cautious because of particular issues. Another group of learners have negative attitudes towards m-learning and are not willing to embrace it. The third group is made up of learners who are eager to embrace m-learning.

Cautious approach to m-learning

The learners who are reluctant to embrace m-learning were apprehensive about the absence of a teacher in front of the room and how this would affect learners' understanding of concepts. Some learners mentioned distractions associated with the use of mobile technologies. Other learners were concerned that it could take longer to complete tasks; given the flexibility of the m-learning mode, these learners worried that this could lead to procrastination. Other learners were uncomfortable with adopting m-learning based on the credibility of qualifications obtained using this learning mode. One learner was concerned about the discipline required for this mode of learning. Some learners reported the need for an improved network infrastructure and necessary resources that would enable seamless m-learning before adopting m-learning. Some learners felt uneasy about the lack of inclusivity for learners who could not afford mobile devices.

Not keen to embrace m-learning

Learners who are not keen to embrace m-learning expressed a variety of perspectives. One student argued that mobile devices were used mainly to learn life skills, not educational content. Another learner felt m-learning was hard. Other students reported that it was easier to understand content in the presence of an instructor. Another learner stated that the credibility of the program would be doubted and also that this mode did not provide a competitive edge in the job market.

Learners enthusiastic about m-learning

The learners who are keen to embrace m-learning gave various reasons for this positive attitude. Learners who are working mentioned that it was difficult to get time off work to pursue academic endeavours; therefore, m-learning could be a solution to this problem. One student was keen because m-learning allowed learners to play back recordings to clarify information. However, another student pointed out that while m-learning allowed learners to repeat or fast-forward content, at times concepts would not be understood and would require an instructor to explain more. Another student commented that m-learning would be more engaging as shy learners could ask questions behind the screen. Other learners felt that m-learning would be more convenient given that some lecturers wanted to have classes when it was not always convenient for learners like after hours, or too early in the morning or during weekends.

5.3.7.7 Readiness to adopt m-learning

Zimbabwean students are not in agreement regarding learners' readiness for m-learning. Some learners feel they are ready to embrace m-learning but have several concerns related to distractions, self-learning skills, the reliability of information accessed online, the implications of the absence of face-to-face interactions with instructors, how this mode of learning is perceived by other people, and whether instructors are competent to use the technology.

Some learners are confident they are ready for m-learning, particularly those who have jobs. Learners reported that for those students who are busy with work and study, m-learning would cut down costs and allow them to work and study without taking time off work. Another learner suggested that m-learning would provide a win-win situation: taking time off from work is difficult, so m-learning would enable him/her to work and achieve personal goals. Another learner suggested that some parts of the courses could be delivered via m-learning, making it more convenient for learners.

It is not surprising that some students are not keen to embrace m-learning since they do not perceive mobile technologies as educational tools (Keengwe and Bhargava 2014; Maketo and Balakrishna 2015). This calls for a mindset change which can be done by incorporating learning activities on mobile devices so that learners can appreciate the use of mobile technologies in extending teaching and learning. Learners are keen to embrace m-learning based on previous experiences and the characteristics or benefits of m-learning. Relative advantage is recognised as a key facilitator of m-learning adoption. In agreement with quantitative studies, relative advantage or perceived usefulness are important contributors to increasing the intention to use m-learning (Mtebe and Raisamo 2014; Kim, Lee and Rha 2017; Cheng 2015). It should be noted that learners who are keen on embracing m-learning would like a seamless environment with adequate Internet connectivity and technological infrastructure.

5.4 New findings

The new findings from focus group discussions with learners are shown in Table 5. 16. Similarities between the initial proposed model and the data are depicted by black double-pointed arrows. Where the data contradicts what was in the initial proposed model, a red arrow is used with new findings emerging from the data shown in italics. There were not many findings that matched the initial proposed model. The few that did included infrastructure as a m-learning challenge, usability as a factor influencing adoption of m-learning, and portability and connectivity under m-learning characteristics.

New findings emerging from the data collected from the university learners included device issues and affordability as m-learning challenges. According to the learners, factors that influence m-learning adoption are the accessibility and affordability of mobile devices, the suitability of mobile devices and several m-learning characteristics such as convenience, increased engagement, increased access, flexibility and self-learning. Learners are cautious about m-learning and wary about distractions and whether they will fully grasp concepts. Other causes of concern hinged on the quality of learning and how this mode of learning was perceived by others and how it would not be inclusive of those without the requisite mobile devices. Some students' experiences with m-learning shed light on the reasons why some learners were eager to embrace m-learning while others shunned it. Several m-learning characteristics discussed by learners based on their experiences included convenience, increased engagement, increased access, flexibility and self-learning.

Table 5. 16 Findings from focus group discussions with learners

Main aspects in initial proposed model	**New Findings in data collected**
M-learning challenges	**M-learning challenges**
Infrastructure	Infrastructure
Investment costs	Investment costs
Policies	Policies
	Device issues
	Affordability
Factors influencing m-learning adoption	**Factors influencing m-learning adoption**
Culture	Culture
Cheaper mobile phones	Cheaper mobile phones
HCI	HCI
Usability	Usability
	accessibility & affordability of suitable mobile devices
Pedagogy	
Learners' expectations	
Pedagogy	**Pedagogy**
Learners' expectations	Learners' expectations
	Distractions
	Huge transition from traditional face-to-face approach
	Instructors not ready
	Reduced quality of learning
	Inequality
	Lack of inclusivity
	Poorly regarded
	Procrastination
Learning theories	Learning theories
M-learning characteristics	**M-learning characteristics**
Portability	Portability
Blending	Blending
Collaboration	Collaboration
Training	Training
Usability	Usability
Connectivity	Connectivity
Ubiquity	Ubiquity
Technical support	Technical support
Interactivity	Interactivity
Context	Context
Mobility	Mobility
	Flexibility

Legend	
double pointed black arrow = similar findings from data and model	
red arrow= findings from data contradict initial model	
italics = new finding from data collected	***italics***
normal print = aspects in the intial model not discussed in data collected	normal print, no arrows, no italics

5.5 Focus group summary

The impact of poor infrastructure as discussed by other stakeholders in the interview phase was echoed by Zimbabwean students. Adequate technological infrastructure will have a major impact on m-learning adoption. The discussions among these students revealed that in Zimbabwe there are pockets of good infrastructure although students would greatly appreciate seamless connectivity. Other major challenges facing m-learning from the student perspective were related to device issues that included unsuitable devices, affordability, accessibility of suitable devices, and battery recharging.

A key factor influencing m-learning adoption was the affordability of suitable mobile devices. Students expressed that suitable mobile devices were out of reach for some learners. Although some learners are keen to adopt m-learning, those learners who are not so keen considered some challenges associated with use of mobile technologies, namely distractions, procrastination of tasks, the change from the traditional face-to-face interaction with the teacher, inequality and lack of inclusivity for learners who did not have suitable devices and how the mode could be poorly regarded.

Some key characteristics of m-learning discussed by students in Zimbabwe institutions were convenience, increased access, flexibility and self-learning in agreement with other stakeholders from the interview phase. Learners felt that m-learning led to increased engagement and self-learning.

5.6 Modification of model

Based on the findings from the focus group discussions, modifications were made to the model presented in the previous chapter. The modifications reflect the new findings. The new findings have the symbol ❖. The modifications add to all the existing features of the previous model such as, in regard to m-learning issues, learners discussed how the mode was poorly regarded and under pedagogy examples are huge transition from traditional face-to-face mode, reduced quality of learning and leads to procrastination. The modifications to the model are shown in Figure 5. 10.

Key for themes and sub-themes from findings:

Prefix to sub-theme	Meaning
❖	Sub-theme emerging from focus group discussions

M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning Characteristics
❋ Distraction to academic work ❋ Device issues ❋ Privacy ❖ ***Poorly regarded***	ʘ Infrastructure ʘ Cost of infrastructure ʘ Policies ❋ Unsuitable mobile devices ❖ ***Affordability*** ❖ ***Instructors not ready*** ❖ ***Inequality and lacks inclusivity***	ʘ Cheaper mobile phones ʘ Culture ʘ Usability ʘ HCI ❋ Affordability of mobile devices Mobile devices more accessible than laptops or PCs ❋ Advance STEM ❋ Institutional support ❋ Acceptability of m-learning ❖ ***Mobile device accessibility and suitability***	ʘ What constitutes learning? ʘ Learning theories ʘ Stakeholders' expectations ❋ Dynamic learning ❋ Self-learning ❖ ***Poor learning habits*** ❖ ***Huge transition from traditional face-to-face mode*** ❖ ***Reduced quality of learning*** ❖ ***Leads to procrastination***	ʘ Connectivity ʘ Ubiquity ʘ Mobility ʘ Training & support ʘ Collaboration ʘ Blending ❋ Increased access ❋ Convenience ❋ Flexibility ❋ Self-learning ❋ Personalised learning ❖ ***Increased engagement*** ❖ ***Self-learning***

Figure 5. 10 Modified model after focus group discussions

5.7 Conclusion

The chapter analysed the data from the focus group by employing the six-step thematic analysis. Three focus group discussions were conducted with a total of twenty (20) participants. The chapter gives an example of how the initial codes were generated for the focus group discussions. Analysis of the focus group discussions with students confirmed the findings from the literature review and the interviews. The analysis confirmed the data from interviews which are: (1) M-learning challenges, (2) m-learning characteristics, (3) factors influencing m-learning adoption, (4) adoption and (5) m-learning issues. Although no new aspect emerged from the focus groups, additional sub-themes from the existing five themes were generated from the focus group discussions. Four sub-themes emerged under the themes pedagogy and three sub-themes were generated m-learning challenges, with m-learning issues, factors influencing m-learning adoption and m-learning characteristics each generating a single new sub-theme.

Students had divergent views about self-learning. While some learners feel they are self-learners and are ready for m-learning, some students have their reservations and feel that they are not independent enough to take on m-learning. Similarly, student opinions were divided regarding the acceptance of m-learning. Some learners, based on their previous experience with m-learning, are willing to embrace m-learning while some learners are not as keen on m-learning as they have concerns on how it will impact their learning. These findings have implications on m-learning implementation. It is necessary for different stakeholders to have a clear understanding of what m-learning involves and the impact m-learning will have on teaching and learning. Chapter 6 deals with the analysis of the survey data.

Chapter 6

6. Quantitative data analysis

6.1 Introduction

This chapter presents the quantitative data analyses and reports the results. The quantitative data analysis is the third phase of the mixed-methods approach used for this study. The first two phases which took a qualitative approach consisted of the interviews and focus group discussions respectively. This chapter follows the second phase of the qualitative data analysis (focus group discussions) (chapter 5) which discussed the data analysis method used to analyse the focus group discussions data collected from learners.

This chapter starts by discussing the survey questionnaire structure, the survey sample and the data collection process. This is followed by the data analysis which starts off with the descriptive statistics followed by the exploratory factor analysis (EFA). Themes emerging from the EFA are discussed, and the chapter concludes by modifying the model from the previous chapter to incorporate the new findings from the quantitative analysis.

6.2 Questionnaire structure

The questionnaire was divided into two main sections. The first section consisted of questions intended to capture the demographic characteristics of the participants. The remainder of the survey sought to gather information on the current use of mobile technologies by participants, experiences with mobile technologies as well as some scaled-response questions from which to gauge student perceptions on use of mobile technologies in learning. There last question was an open-ended question in which participants could add any comments on m-learning.

6.2.1 Target population and sample

The target population comprised university students (male and female) from Zimbabwe universities. The sample population was 39 less than the original set sample size of 397 (section 3.11.2), resulting in a sample of 358 participants; therefore, the valid response rate is 90.1%. It was a challenge to find participants willing to complete the survey given the socio-economic challenges in Zimbabwe. While potential participants wanted to help, most seemed preoccupied with efforts to make ends meet, which meant the time needed to complete they survey was a luxury they could not afford.

6.2.2 Data collection

Data collection started off with an online survey which was enthusiastically received but yielded poor results because students were deterred by the cost of Internet data bundles. The online Qualtrics survey was widely distributed via email and social media platforms (Facebook, Instagram, Twitter and WhatsApp). Through Qualtrics, 219 students attempted to respond to the survey but only 62 completed the survey. The response rate for the online survey is not easy to determine as the survey link was passed to different people to share via different networks (beyond the 219 that attempted to respond). However, it is clear that the response rate for the online survey was poor.

The online survey remained open, with the researcher dispatching a paper-and-pen instrument to continue data collection. The online survey was active for a year. Six hundred (600) hard copies of the survey were distributed to different universities. Out of these, 296 were deemed useful for the survey, five did not go beyond the demographics section and were excluded from analysis. This shows a response rate of 49%. The high response rate could be attributed to asking the students to complete the survey there and then rather than taking it away to complete and then bring back.

6.2.3 Data capture

The data capture involved three phases (Jones and Hidiroglou 2013) described in Figure 6. 1.

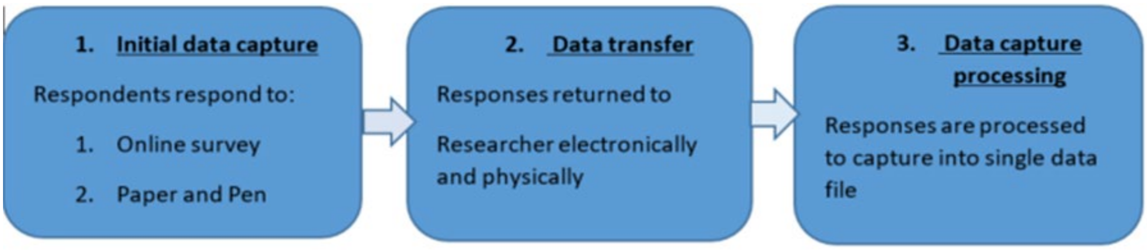


Figure 6.1. Data capture phases

1. Initial data capture

Initial data capture involved the use of the online survey using Qualtrics software. After participants complained that the survey was rather lengthy, which translated to a high cost as more data bundles were required for them to electronically complete the survey, a paper-and-pen instrument was used. All the initial data capture was undertaken by the respondents.

2. Data Transfer

The data from the online survey was electronically transferred; the researcher downloaded the responses using the Qualtrics software. The hard copies were physically collected upon completion and given to the researcher.

3. Data capture processing

The electronic data from Qualtrics was exported to an Excel spreadsheet. The data from the paper-and-pen instrument was appended at the end of the data collected electronically. Capturing data by means of the pen-and-paper instrument was done by manually keying in the data collected from learners. The process was time consuming as the data keyed in had to be double-checked to ensure there were no errors. Once all the data had been captured, the data was exported to SPSS (version 26) for analysis.

6.3 Descriptive statistics

Gender

The female population is above 57%, with the male population just over 40 % (Figure 6. 2).

These demographics are representative of the Zimbabwe population. According to http://worldpopulationreview.com/countries/zimbabwe-population/ in 2019 the male population was 47.68% with the female population being 52.32%.

Gender	Number	%
Female	206	57.5
Male	151	42.2
Total	357	100

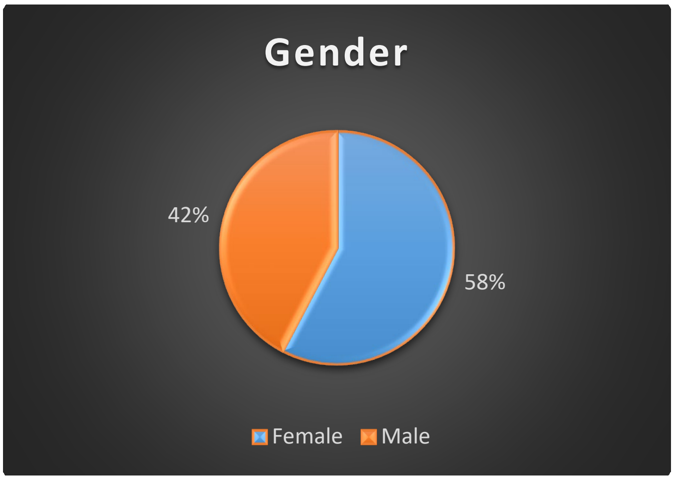


Figure 6.2. Gender

Main field of study

Participants were drawn from various main fields of study, Approximately 25% of the participants were drawn from Science and Engineering, almost 15% of the participants were from main fields such as Law and Social Sciences, very few participants were drawn from Information Technology and Information Systems, contributing to less than 4% of the total participants (Figure 6. 3).

Main field of study	number	%
Other	50	14.6
Accounting	35	10.2
Economics & finance	17	5.0
Information Systems (I.S)	9	2.6
Information Technology	4	1.2
Computer Science	8	2.3
Management	20	5.8
Marketing	15	4.4
Health Sciences	30	8.7
Humanities	41	12
Science and Engineering	87	25.4
Agriculture & forestry	17	5.0
Education	10	2.9
Total	343	100

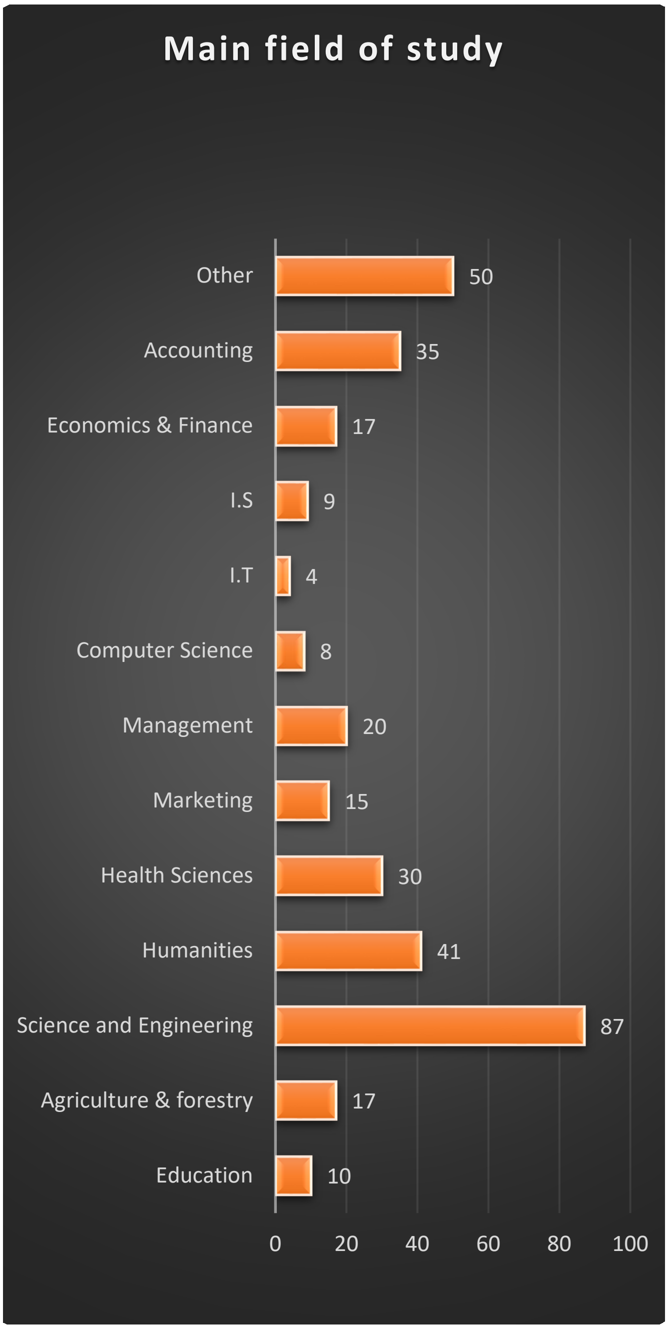


Figure 6.3. Main field of study

Highest Level of Education

Over half of the study's participants have a bachelor's degree (55.3%), with slightly over a quarter of the participants having at most secondary school education (27.2%), and about a tenth of the participants (10.3%) hold a diploma (Figure 6. 4).

Highest level of education	number	%
Secondary school education	90	27.2
Diploma	34	10.3
Bachelor's degree	183	55.3
Postgraduate diploma	5	1.5
Master's degree	19	5.7
Total	358	100

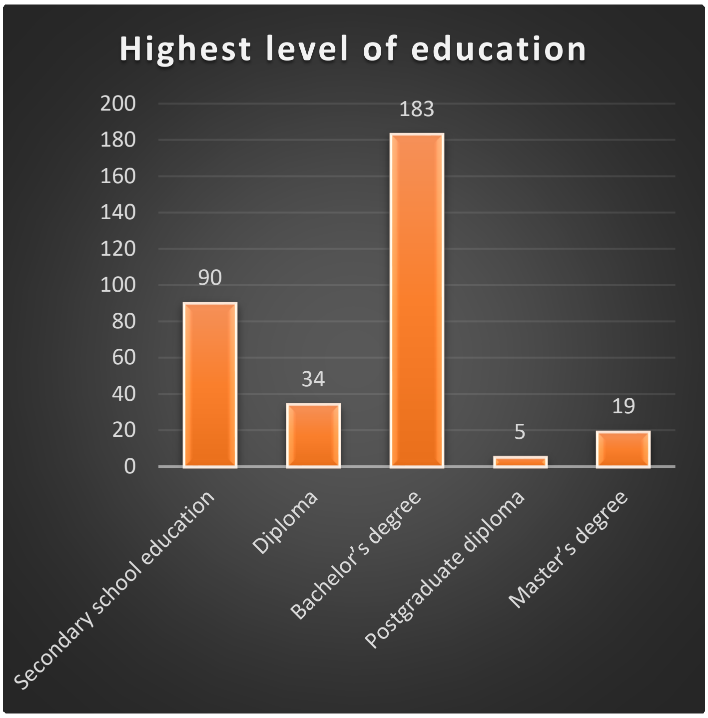


Figure 6.4. Highest level of education

Current Level of Study

Over half of the participants (56%) surveyed are in either 1st or 2nd year; almost 40% of those surveyed are either in their 3rd or 4th year of study, with exactly 2% in their 5th year of study as shown in Figure 6.5.

Current level of study	number	%
1st year	97	27.6
2nd year	100	28.4
3rd year	69	19.6
4th year	79	22.4
5th year	7	2.0
Total	352	100

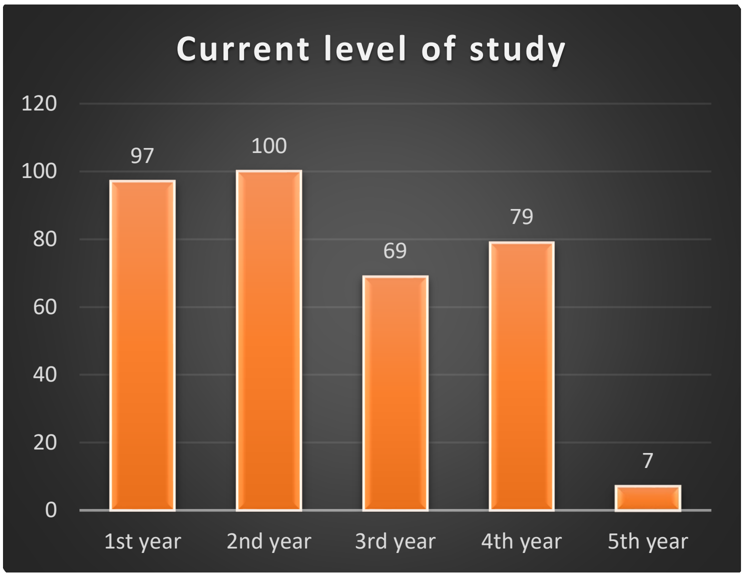


Figure 6.5. Current level of study

Knowledge of m-learning

The data from students who participated in the survey showed that a majority of them know what m-learning is (73.4%) with above a quarter of the students having no knowledge of m-learning (Figure 6. 6). The findings are consistent with the findings of Milošević et al. (2015) in Serbia in which 17% of the learners had poor knowledge of m-learning and the majority had at least a moderate to very good knowledge of m-learning. In developing countries like Myanmar and Nigeria, high levels of m-learning were also reported amongst students (Usagawa 2018; Ajayi, Ayo and Olamide 2019).

Knowledge of M-learning	number	%
No	94	26.3
Yes	264	73.7
Total	358	100

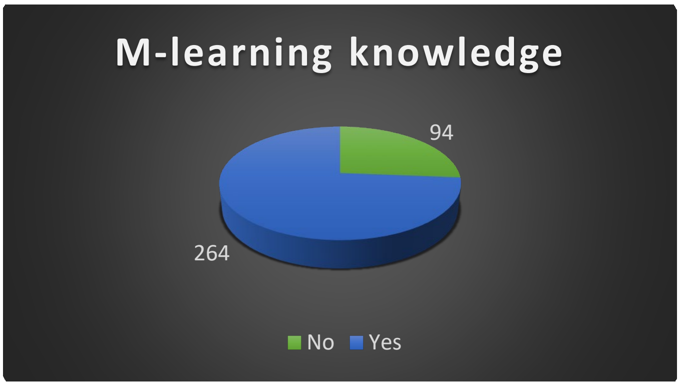


Figure 6.6. Knowledge of m-learning

Mobile devices

There are several studies that report the ubiquity of mobile devices among post-secondary school students (Toperesu, Van Belle and Turpin 2019; Crompton and Burke 2018; Bakhsh, Mahmood and Sangi 2017; Chen et al. 2015). The availability of mobile devices has been discussed as a factor influencing m-learning adoption and implementation with suggestions to expand students' learning beyond the classroom (Crompton and Burke 2018; Iqbal and Bhatti 2016). This study investigated capabilities of mobile devices, types of mobile devices that learners own, and the features of the mobile devices owned by students.

Mobile device use capability

Only 2% of participants have been using mobile devices for less than a year, with the remaining 98% describing their ability to use mobile devices as ranging from intermediate to advanced users (Figure 6.7).

Mobile use capability	number	%
Novice (less than 1 year)	7	2.0
Intermediate (1-3 years)	80	22.5
Advanced (more than 3 years)	268	75.5
Total	355	100

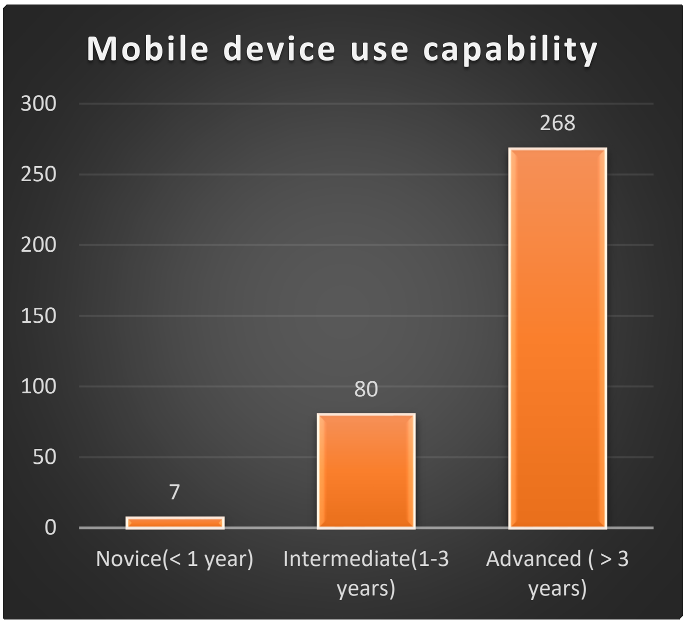


Figure 6.7. Mobile device capability

Mobile device ownership

A basic cell phone is used for sending SMS and making calls without requiring Internet access; a minority of students (just over 15%) own a basic cell phone. Most of the learners have access to at least one mobile device that is Internet-enabled. Smartphones and laptops are the most prevalent mobile devices amongst university students.

At least 70% of the learners have either a smartphone or a laptop and, in some cases, students own both. For mobile devices with Internet access, the tablet seems the least preferred by university students, with just over 28% possessing a tablet (Figure 6. 8). This study shows that students do have access to a wide range of mobile devices, these findings are consistent with earlier studies (Farley et al. 2015; Oyelere et al. 2016; Ajayi, Ayo and Olamide 2019; Santos 2015), including lower-income students. This study shows that some learners own more than one mobile device that is Internet-enabled.

Basic cell phone	number	%
No	300	84.7
Yes	54	15.3
Total	354	100
Smartphone	n	%
No	87	24.6
Yes	267	75.4
Total	354	100
Tablet	n	%
No	253	71.5
Yes	101	28.5
Total	354	100
Laptop	n	%
No	100	28.2
Yes	254	71.8
Total	354	100

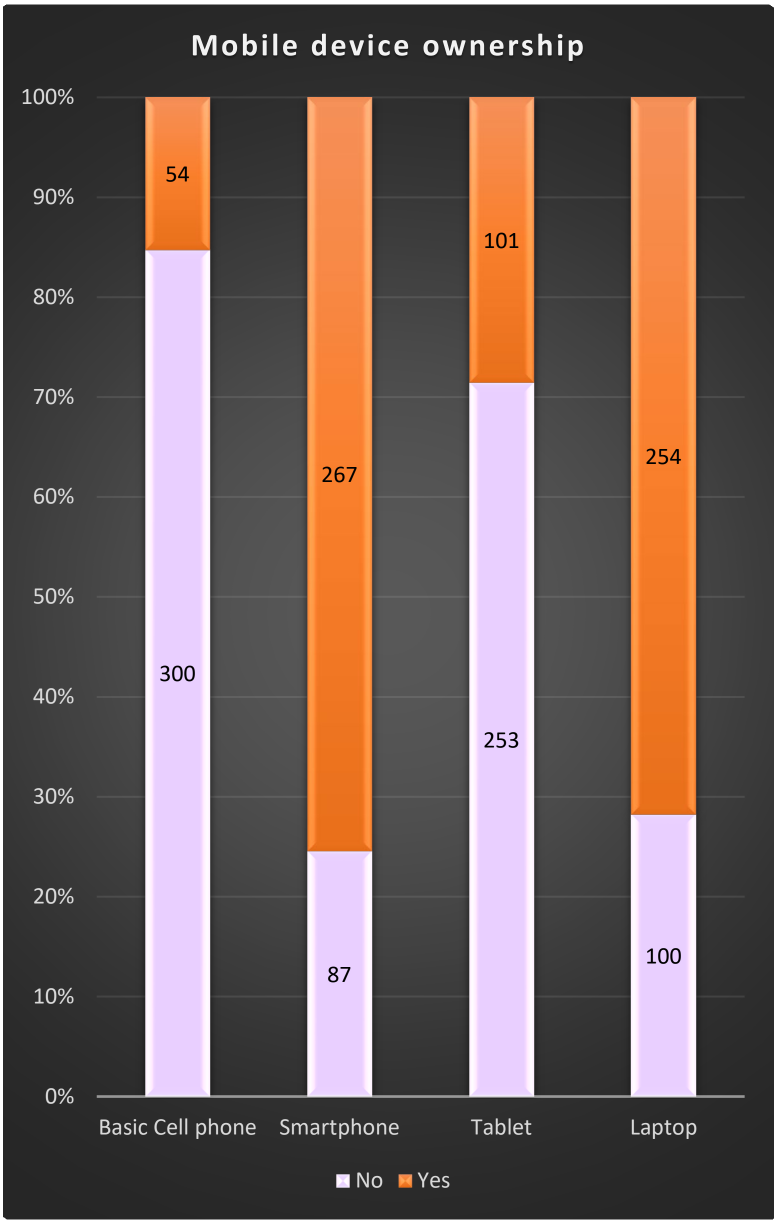


Figure 6.8. Mobile device ownership

Mobile device preference

From the three mobile devices that are Internet-enabled, the size of the device appears to be a factor when using a mobile device for educational purposes. Preferences for using a smartphone vs tablet vs a laptop were mixed. Students showed a greater preference for laptops (69%) for academic purposes, with a little more than 20% opting for a tablet and just below 10% selecting a smartphone as the device of choice for educational studies (Figure 6. 9). Similarly, a greater preference for laptops for studying purposes was also reported for Australian and Ugandan students (Kaliisa, Palmer and Miller 2019).

The findings are unsurprising as previous studies have shown that one reason why learners do not use mobile devices is related to the screen size of the device, and that larger screen sizes increased the affordance of mobile learning in accomplishing academic tasks (Ally and Wark 2018; Crompton and Burke 2018). For fieldwork, some students have expressed a preference for using a smartphone rather than a tablet to reduce risk of damage and theft (Welsh et al. 2018).

Preferred Mobile device	number	%
Smartphone	31	8.7
Tablet	79	22.3
Laptop	245	69
Total	355	100

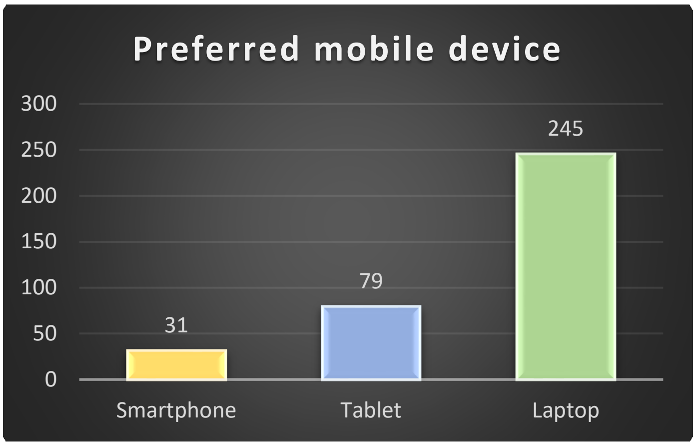


Figure 6.9 Mobile device preference

Operating System (OS) on mobile phone

Most students (70.9%) have mobile phones that have the Android OS some examples of such phones are Samsung phones. The apple iOS and Windows running phones trail behind Android (15.1% and 13.4% respectively) (Figure 6.10).

Apple products remain rather exclusive amongst learners in this study with similar findings also reported amongst Nigerian learners (Ajayi, Ayo and Olamide 2019). Android products are increasingly cross-platform and can interface with a number of plug-and-play devices Ally and Wark (2018). The findings are a contrast to the findings by Ally and Wark (2018) in which Apple products made up (65%) of the student devices in Canada, in study at Stanford university from 57 students interviewed 79% owned an iPhone and 12% owned iPod Touch devices (Ames 2013).

OS on mobile phone	number	%
Apple iOS	53	15.1
Android	249	70.9
Windows	47	13.4
Blackberry	1	0.3
Other (Tizen)	1	0.3
Total	351	100

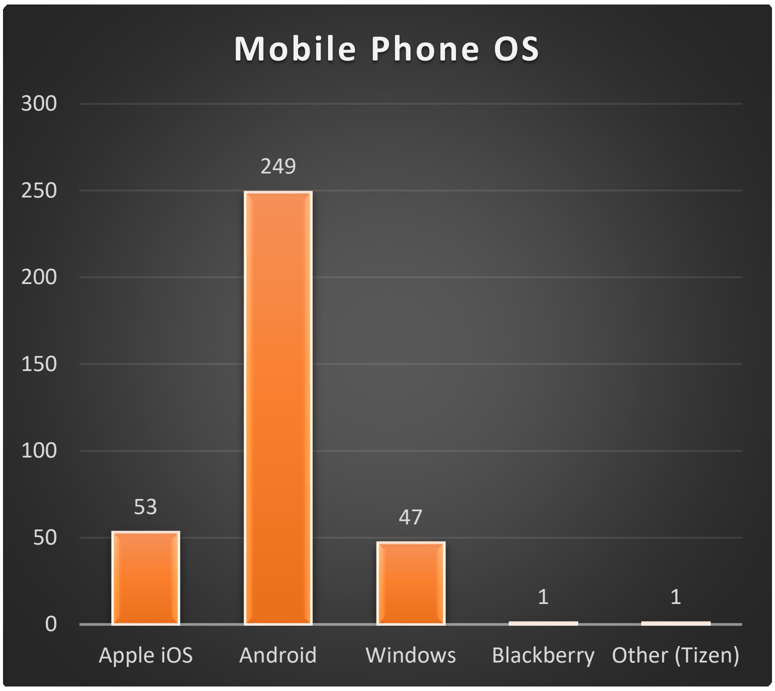


Figure 6.10 OS on mobile phone

Internet access

The history of Internet use in Zimbabwe dates back to 1997, when the national Posts and Telecommunication Corporation established the national Internet backbone to sell bandwidth to private Internet service providers. In the year 2000, only 0.4 % of the population were Internet users (International Telecommunication Union 2014) with statistics indicating a rise to 15.7% in 2011 in the same report.

Most learners in Zimbabwe tertiary institutions have Internet access on their mobile devices. Over 90% of students have Internet access via one of the following: smartphones, tablets or laptops. Just over 60% of the learners have Internet access at their homes (Figure 6. 11). Home Internet access would be mostly fixed broadband connections. It is evident that most students rely heavily on mobile Internet access. It has been reported that the cost of Internet service remains a barrier in Zimbabwe and other countries such as Mexico, Brazil, Colombia and Romania (International Telecommunication Union 2018).

Given that most learners own a mobile device, it is unsurprising that over 96% of the learners use mobile applications at least frequently, with close to 60% of the learners indicating that they always use mobile applications. Less than 4% of the learners rarely use mobile applications.

Mobile device Internet access	number	%
Don't have it	27	7.5
Have it	331	92.5
Total	358	100
Home Internet access	number	%
Don't have and cannot afford it	130	36.6
Have it	219	61.7
Don't have it and don't want it	6	1.7
Total	355	100

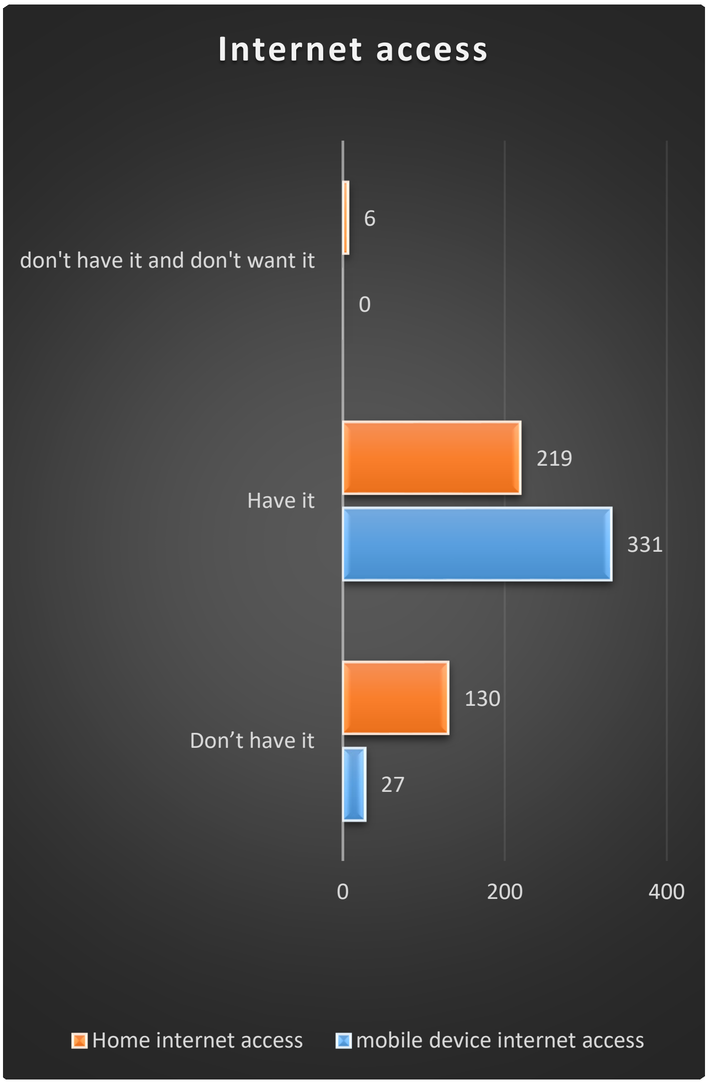


Figure 6.11 Internet access

Frequency of use of mobile applications

Over 95% of the learners frequently use mobile applications with less than 5% rarely using mobile apps (Figure 6.12).

Frequency of Mobile applications usage	number	%
Seldom	13	3.6
Frequently	134	37.4
Always	211	58.9
Total	358	100

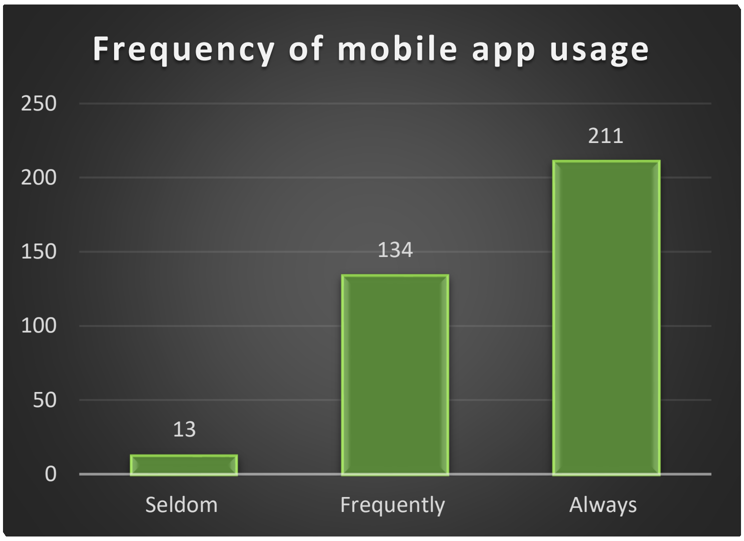


Figure 6.12 Frequency of use of mobile applications

Social media usage

Over 90% of the learners reported that they access social networks via their mobile devices. About 3% of the learners do not access social networks via their mobile devices (Figure 6. 13).

Mobile access of social networks	number	%
Never	12	3.4
Seldom	14	4.0
Sometimes	59	17.0
Always	263	75.6
Total	348	100

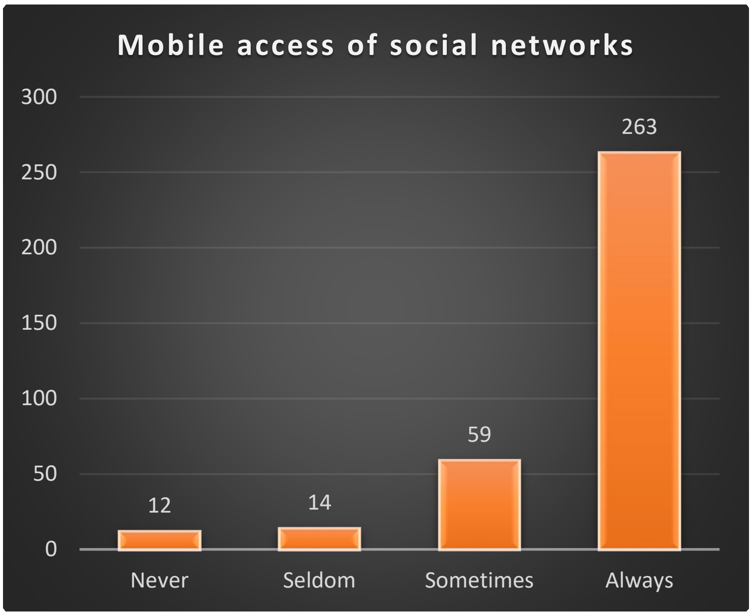


Figure 6.13 Social media usage

Specific social media usage

Most learners in Zimbabwe tertiarty institutions use social media platforms. WhatsApp is the most predominantly used social media network, as the free-to-download app allows users to respond to individual and group chats quickly as well as make voice and video calls. Just under 2% of the learners do not use WhatsApp, with over 80% always using WhatsApp (Figure 6. 14).

The other main social media networks used by learners are Youtube and Facebook. You Tube is a video-sharing platform owned by Google. YouTube allows users to upload, view rate and comment on videos, and offers a variety of content uploaded by users including educational videos. Just above 3% of the learners do not use You Tube, with almost 70% of the learners using YouTube sometimes. Facebook is also popular with students with over 90% of them using a social networking service. Facebook allows users to post text, photos and multimedia which is shared with people with whom they interact.

Most learners do not use use Snapchat, LinkedIn and Twitter at all. Snapchat is a multimedia messaging app, LinkedIn is a more business- and employment-oriented platform. Twitter offers micro-blogging and social networking services. These social networks may be less popular with learners for educatonal purposes. Instagram has over 70% of studentd using it, almost a quarter of the students do not use Instagram.

WhatsApp	number	%
I do not use	6	1.7
Seldom	6	1.7
Sometimes	43	12.1
Always	300	84.5
Total	355	100
Twitter	number	%
I do not use	123	35.1
Seldom	52	14.9
Sometimes	107	30.6
Always	68	19.4
Total	350	100
Instagram	number	%
I do not use	93	26.4
Seldom	42	11.9
Sometimes	112	31.8
Always	105	29.8
Total	352	100
Facebook	number	%
I do not use	29	8.2
Seldom	39	11.0
Sometimes	162	45.8
Always	124	35.0
Total	354	100
YouTube	number	%
I do not use	12	3.4
Seldom	26	7.3
Sometimes	122	34.3
Always	196	55.1
Total	356	100
Snapchat	number	%
I do not use	210	59.8
Seldom	50	14.2
Sometimes	59	16.8
Always	32	9.1
Total	351	100
LinkedIn	number	%
I do not use	179	50.9
Seldom	48	13.6
Sometimes	84	23.9
Always	41	11.6
Total	352	100

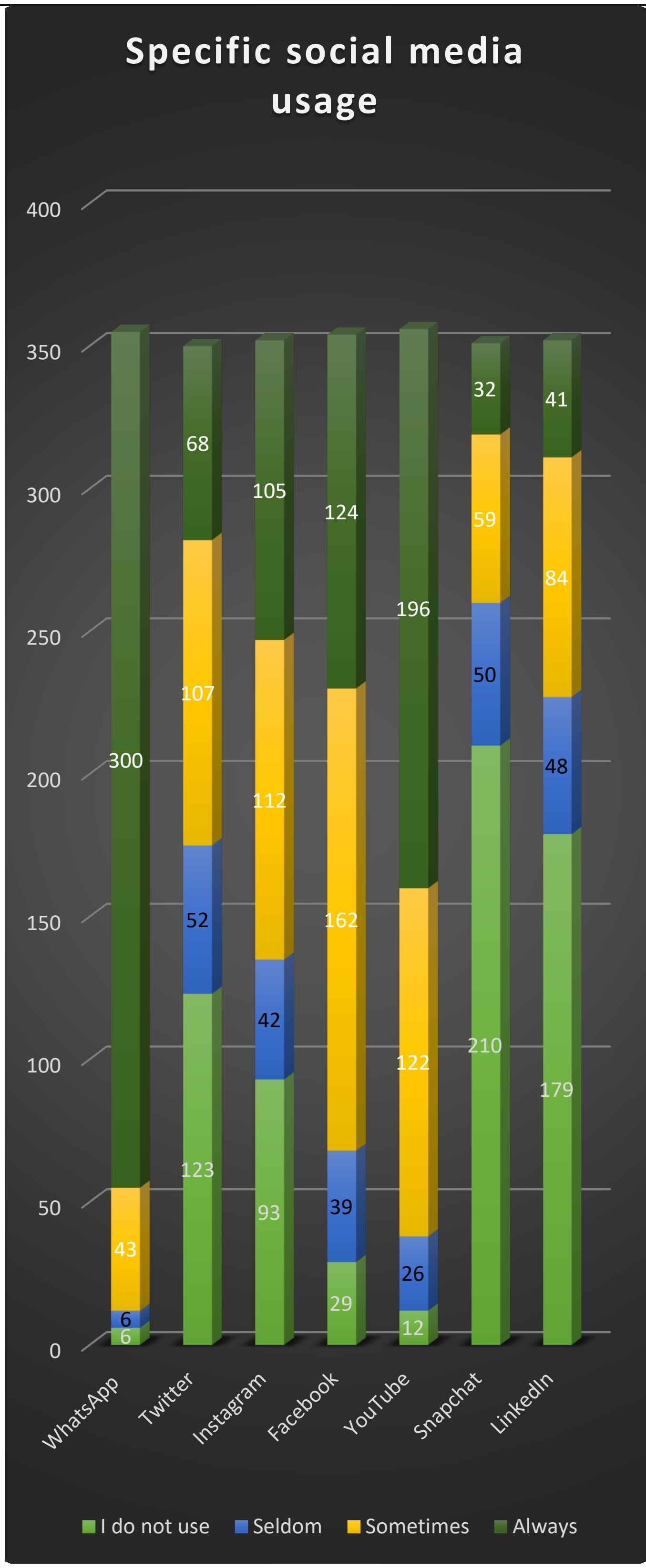


Figure 6.14 Social Media usage

Most learners (70.9%) use their mobile devices for independent learning, with just over 5% reporting that they never use mobile devices for academic purposes (Figure 6. 15).

Period mobile device is used for studying purposes	number	%
During lessons	36	10.2
Between lessons	48	13.6
For independent studying	251	70.9
Never use if for studying	19	5.4

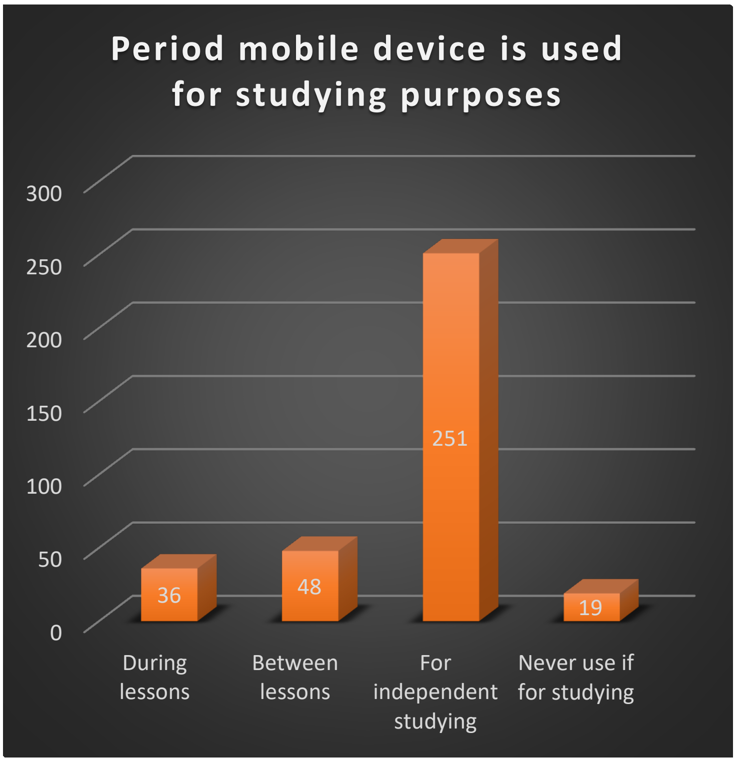


Figure 6.15 Period that mobile device is used for studying purposes

In regard to the library services presented to students, students are most interested in just one service: the database search (65.8%). Little interest was shown in chat sessions with librarians, book and movie reviews, library-related videos, and podcasts (Figure 6. 16).

chat sessions with librarians	number	%
No	293	82.5
Yes	62	17.5
Total	355	100
database search	number	%
No	120	34.2
Yes	231	65.8
Total	351	100
book and movie	number	%
No	293	82.5
Yes	62	17.5
Total	355	100
library related	number	%
No	261	73.5
Yes	94	26.5
Total	355	100

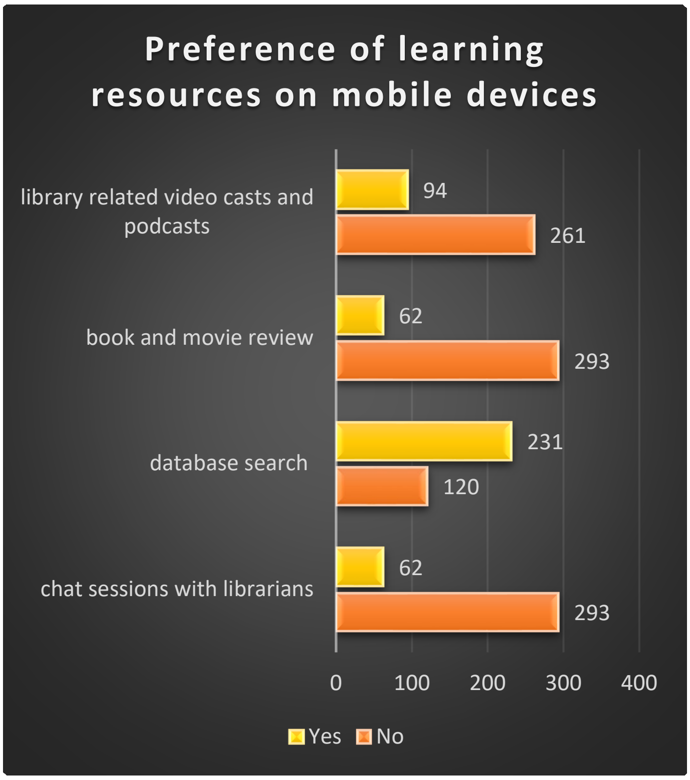


Figure 6.16 Preference of learning resources on mobile devices

From the learning resources presented to learners, the majority of the learners (81.3%) are most keen to access lecture power point slides on their mobile devices, with the least preferred resource being flashcards and interactive games. About 60% of the learners are interested in both course-related videos and eBooks (Figure 6. 17).

Lecture PowerPoint slides	number	%
No	66	18.8
Yes	286	81.3
Total	352	100
audio recordings	number	%
No	182	51.9
Yes	169	48.1
Total	351	100
course-related videos	number	%
No	130	37
Yes	221	63
Total	351	100
digital copies of printed content	number	%
No	197	56.1
Yes	154	43.9
Total	351	100
EBooks	number	%
No	125	35.6
Yes	226	64.4
Total	351	100
Flashcards & interactive games	number	%
No	239	68.1
Yes	112	31.9
Total	351	100
hyperlinks to course related material	number	%
No	225	64.1
Yes	126	35.9
Total	351	100

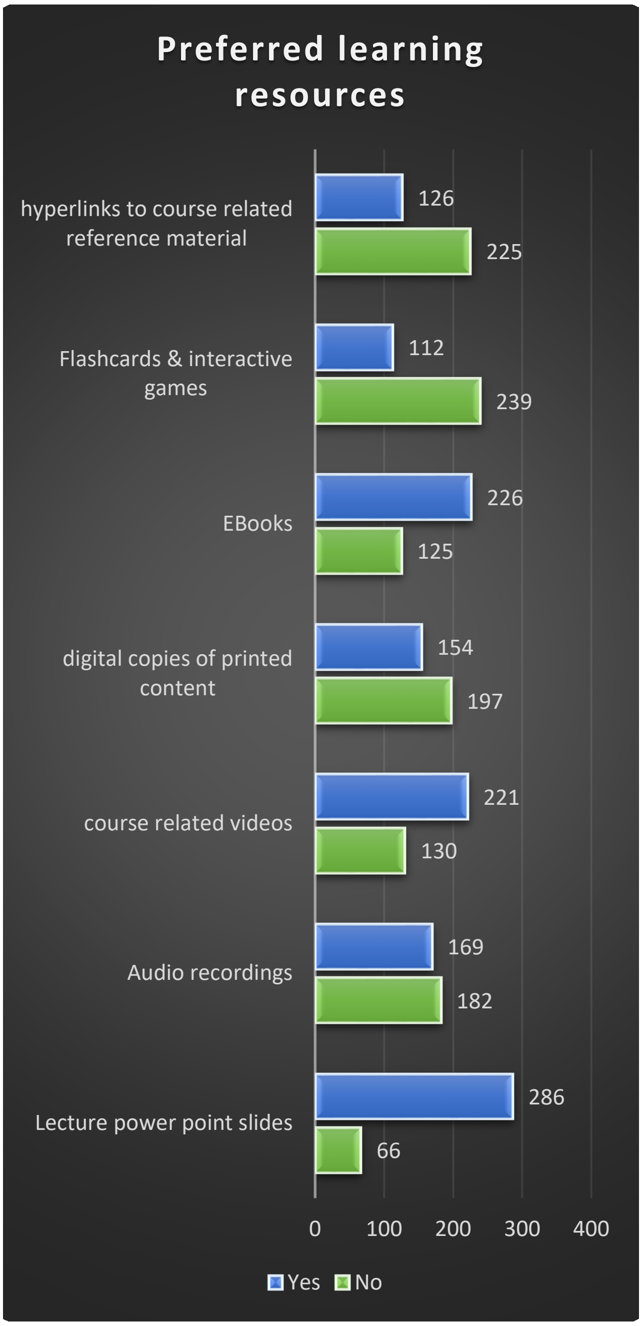


Figure 6.17 Preferred learning resources

6.4 Application of steps to study data set

Steps for exploratory factor analysis (EFA) are comprehensively discussed in section 3.13.

6.4.1 Step 1: Is data suitable for factor analysis?

The data set was screened to find missing values. Across the data set for the different themes, none of the themes had over 4% of missing data. Factor analysis should consider missing values, and cases with missing values should be disregarded to prevent inaccuracy of findings (Tabachnick, Fidell and Ullman 2007) From the 358 usable responses, it was decided to use all responses for EFA given that the missing values were at most 4% for all themes. The missing items were substituted using the expectation maximisation (EM) approach in SPSS v26 (Pallant 2005).

6.4.1.1 Data techniques applied and results of measures for data set

A summary of the data techniques applied to the data set to check for suitability for EFA and to check for reliability of results are shown in Table 6. 1.

Table 6. 1 Summary of data set values

Theme	KMO	Bartlett's test of sphericity			Cronbach's alpha
		$\chi2$	Df	p-value	
When using mobile devices	0.766	653.024	15	<.0001	0.79
Current use of m-learning services	0.816	740.494	10	<.0001	0.846
Experience with m-learning	0.821	605.537	15	<.0001	0.796
What I am enabled to do using mobile devices	0.916	1944.38	55	<.0001	0.902
Learning habits	0.846	1639.11	66	<.0001	0.803
When I am using my mobile device for studying	0.754	677.052	21	<.0001	0.717
My learning style	0.6	541.527	10	<.0001	0.52
Why m-learning can be a challenge to implement	0.834	1233.53	66	<.0001	0.815
Reasons for embracing m-learning	0.795	944.793	36	<.0001	0.792

The values for KMO the variables considered for EFA had one that could be described as mediocre under the theme my learning style (KMO=0.6). The rest of the values were between 0.754-0.916, above 0.7 is widely accepted in the literature with 0.916 considered as superb.

The Bartlett's test proved that there was no identity matrix, A significant ($p<0.001$) sphericity of chi-square ($\chi2$) suggests that the data set and correlation matrix are factorable. The value of Cronbach's α for the several themes ranged from 0.0717-0.902 with the exception of the theme my learning style (Cronbach's α=0.52) which was low. There was no item under this theme with five items that could be deleted to increase the value of Cronbach's α.

There is a suggestion that the common notion of there being a threshold of acceptability for alpha values if only as rule of thumb minimum of 0.7, should not always be seen as implying that lower values of α should not be taken as an unsatisfactory instrument Taber (2018). van Griethuijsen et al. (2015), in their study, attributed the low value of Cronbach's α to the low number of contributing factors, and asserts that increasing the number of items would lead to acceptable values of Cronbach's α. In this study, only five items were contributing to this factor and the researcher is also convinced that adding more items would have increased the value of α. Taber (2018) asserts that alpha alone may not be sufficient to determine the suitability of the instrument, but can be used in conjunction with other tools such as factor analysis. Factor analysis is conducted below and the theme, my learning style, will still be considered.

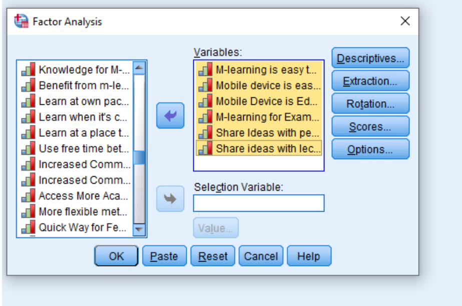
6.4.2 Step 2: How will the factors be extracted?

The Principal Components Analysis (PCA) was used in this study using SPSS v26 statistical software. Below are tables that give the actual steps involved in SPSS v26 and the corresponding screenshots from the SPSS statistical software. The descriptions below are based on the first theme *when using mobile analysis,* with a similar approach used for the rest of the themes.

<table>
<tr>
<td>To access the main dialog box Figure 6. 18 to the right was done selecting:

Analyze → Dimension Reduction → Factor

Select the variables for the theme.

Several options are available. Each one was accessed starting with clicking on the first one Descriptives to access the dialog box in Figure 6. 19.</td>
<td>
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</table>

Figure 6.18 Accessing main dialog box

The selected options are shown in Figure 6. 19 Initial solution and Univariate Descriptives (under Statistics), Coefficients, Determinant, and KMO and Bartlett's test of sphericity (under Correlation Matrix).

- The Univariate descriptives give the means and standard deviations for each variable.
- The Coefficients produces the R-matrix (correlation matrix)
- KMO and Bartlett's test of sphericity produce the Kaiser-Meyer-Olkin values for sampling adequacy and Bartlett's test
- **Continue** was selected to return to the main dialog box.

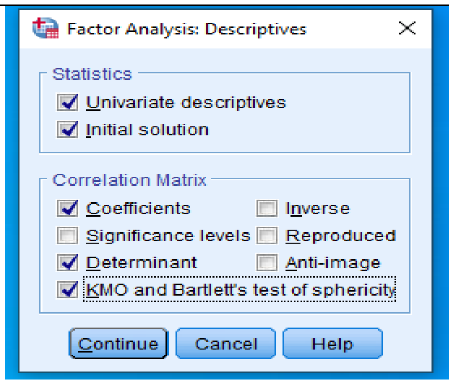


Figure 6.19 Factor analysis descriptives

- Select Extraction**…** which gives you Figure 6. 20
- Select **Principal axis factoring** from the **Method** pull-down menu.
- Select Unrotated factor solution.
- Select **Scree plot** box.

In Figure 6.20, Click on **Based on Eigenvalue** under **Extract.**

As shown in Figure 6.21, Click on Fixed number of factors, and type 2 for the Fixed number of factors to extract

Click **Continue** to return to the main dialog box.

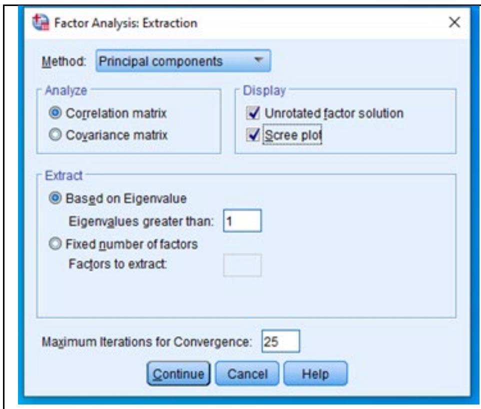


Figure 6.20 Rotation(left)

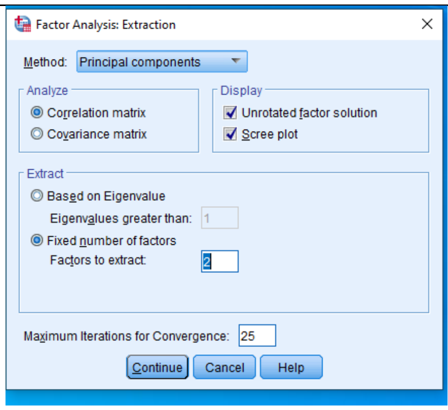


Figure 6.21 Rotation(right)

Click on **Rotation…** which will give you Figure 6. 22

Varimax, and Rotated solution were checked.

- Varimax rotation creates a solution in which the factors are orthogonal (uncorrelated with one another), which can make results easier to interpret and to replicate with future samples.
- The researcher believed that the factors (latent concepts) were correlated, so **Direct Oblimin** was chosen, which provided an oblique solution allowing the factors to be correlated.

• Click on **Continue**

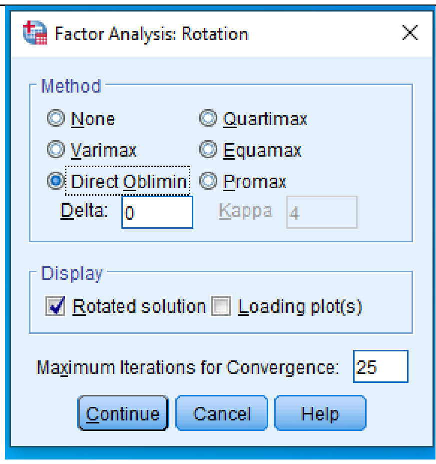


Figure 6.22 Factor analysis rotation

Figure 6. 23 shows the factor scores dialog box which was accessed by clicking on ‘scores’.

The selected options were Bartlett under ‘save as variables’.

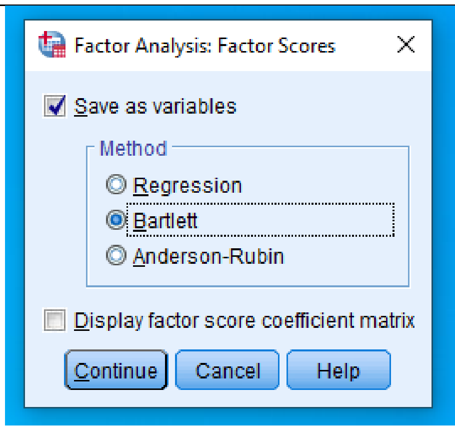


Figure 6.23 Factor scores

The options dialog box was obtained by clicking on ‘options’ in the main dialog box (see Figure 6.24).

The selected options were Exclude case listwise under Missing values

And both options under Coefficient Display format with an Absolute value below: 0.4.

Missing values are a problem for factor analysis, so the selected option excluded any participant’s response that had missing data.

Sorting by size will order variables according to their factor loadings. Suppressing absolute values below 0.4 ensures that factors within +/- 0.4 are not displayed in the output, making interpretation simpler.

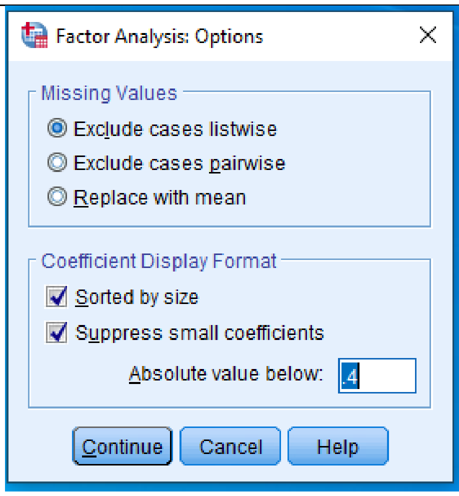


Figure 6.24 Options

6.4.3 Step 3: What criteria will assist in determining factor extraction?

In all cases, the Kaiser criterion was taken into consideration as seen in section 6.5. Scree diagrams were also taken into consideration although the criterion that took precedence involved checking whether the rotated factor pattern demonstrated a simple structure as suggested by (Suhr 2006; Reio Jr and Shuck 2015; Schmitt and Sass 2011), also checking whether the variables that load on different factors actually measure different constructs and suggest the solution that produces the best fit (Williams, Onsman and Brown 2010).

6.4.4 Step 4: Selection of rotational method

The orthogonal rotation (varimax) was used for all themes.

6.4.5 Step 5: Interpretation

The variables attributed to the factors are discussed below in section 6.6 with the factors named accordingly.

6.5 Summary of exploratory factor analysis results conducted using SPSS v26

Altogether, nine questions from the survey were used for the exploratory factor analysis. For each of the questions, the underlying theme of the question is given together with the items under this main theme. The values for sampling adequacy, Bartlett's test of sphericity, p-value and Cronbach's alpha for reliability for each of the underlying themes are provided in tables. This is followed by the extraction method, and a scree plot is presented and then the factor loading and any resulting new factor(s).

6.5.1 When using mobile devices

This is based on the question ***When using mobile devices***, from the survey questionnaire. There were six items under the theme *when using mobile devices*. The values of factorability and reliability are presented in Table 6. 2.

Table 6. 2. Values for factorability and reliability (when using mobile devices)

When using mobile devices				
KMO	Bartlett's test of sphericity ~ $\chi2$	df	p-value	Cronbach's alpha

0.766	653.024	15	<0.001	0.790

An initial run to obtain eigenvalues for each component resulted in two components having eigenvalues over the Kaiser criterion of 1 and in combination explained 67.73% of the variance Table 6. 3.

Table 6. 3 Kaiser criterion (when using mobile devices)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.942	49.035	49.035	2.942	49.035	49.035	2.406	40.100	40.100
2	1.122	18.695	67.730	1.122	18.695	67.730	1.658	27.631	67.730
3	0.713	11.876	79.606						
4	0.444	7.407	87.014						
5	0.410	6.828	93.842						
6	0.369	6.158	100.000						

Extraction Method: Principal Component Analysis.

SPSS v26 extracted 2 factors with a cumulative percentage of 67.73%

The scree plot for ***When using mobile devices*** is explained in Figure 6. 25.

The scree plot, showed two factors with an eigenvalue above 1, with possibly four factors that could be considered.

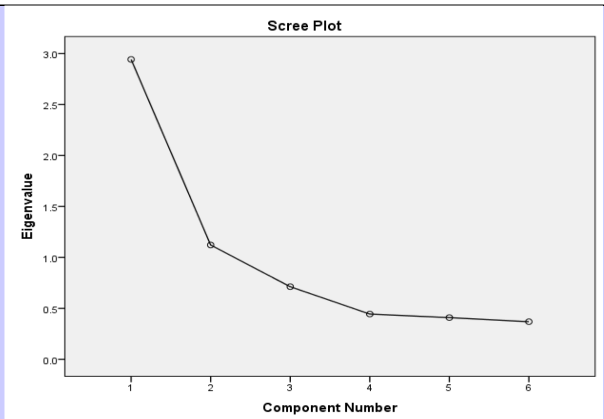


Figure 6.25 Scree plot for when using mobile devices

Factor loading for the items ***(when using mobile devices)*** and the new factors arising from the EFA are shown in Table 6. 4.

Table 6. 4. Factor loading and new factors (when using mobile devices)

Factor loading for when using mobile devices			
Variable	Factor loading		New factor(s)
	1	2	
I experience unreliable Internet connection	0.823		Connectivity
The Internet connection on my mobile is of low speed	0.792		
The small keypad and screen size are a limitation for me to use a mobile device for learning	0.747		
I find it hard to navigate and download educational material using a mobile	0.687		
I find it hard to navigate and download educational material using a mobile		0.891	Performance issues
I struggle to keep the battery for my mobile device charged		0.858	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with A Kaiser Normalization.[a] Rotation converged in 3 iterations.			

The six variables (when using mobile devices) were reduced to two factors: (1) ***performance issues*** and (2) ***connectivity.***

6.5.2 Current use of m-learning services

This is based on the question ***Current use of mobile learning services***, from the survey questionnaire. There were five items under the theme *current use of m-learning services*. The values of factorability and reliability are presented in Table 6. 5.

Table 6. 5. Values of factorability and reliability

Current use of m-learning services				
KMO	Bartlett's test of sphericity ~ $\chi 2$	df	p-Value	Cronbach's alpha
0.816	740.494	10	<0.001	0.846

An initial run to obtain eigenvalues for each component resulted in one component having eigenvalues over the Kaiser criterion of 1 and explained 62.22% of the variance shown in Table 6.6.

Table 6. 6 Kaiser criterion (current use of m-learning services)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.111	62.222	62.222	3.111	62.222	62.222	2.186	43.713	43.713
2	0.747	14.933	77.156	0.747	14.933	77.156	1.672	33.443	77.156
3	0.432	8.635	85.791						
4	0.407	8.148	93.939						
5	0.303	6.061	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted 1 factor with a cumulative percentage of 62.22%.

The scree plot for ***Current use of m-learning*** is explained in Figure 6. 26.

The scree plot had 1 factor above the eigenvalue of 1, with three factors that could be considered.

Figure 6.26. Scree plot for current use of m-learning

Factor loadings for the items (***current use of m-learning***) and the new factors arising from the EFA are shown in Table 6. 7.

Table 6. 7. Factor loadings and new factors (current use of m-learning)

Factor loading for current use of m-learning services			
Factor loading			
Variable	Component		New factor(s)
	1	2	
I use m-learning services to check my academic calendar	0.895		Increased access
I use m-learning services for alerts and warnings	0.791		
I use m-learning service for course registration	0.747	0.401	
I use m-learning service to watch educational videos and listen to audio lectures		0.904	Notification reminder
I use m-learning services to get soft copies of study materials	0.410	0.761	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]			

Five variables were reduced to two factors: ***increased access*** and ***notification reminder.***

6.5.3 Experience with m-learning

This is based on the question ***Experience with m-learning***, from the survey questionnaire. There were six items under the theme *experience with m-learning*. The values of factorability and reliability are shown in Table 6. 8.

Table 6. 8. Values for factorability and reliability (experience with m-learning)

Experience with m-learning				
KMO	Bartlett's test of sphericity ~ $\chi 2$	df	p-Value	Cronbach's alpha
0.821	605.537	15	<0.001	0.796

An initial run to obtain eigenvalues for each component resulted in one component having eigenvalues over the Kaiser criterion of 1 as shown in Table 6. 9.

Table 6. 9 Kaiser criterion (experience with m-learning)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.031	50.511	50.511	3.031	50.511	50.511	2.200	36.661	36.661
2	0.855	14.243	64.754	0.855	14.243	64.754	1.686	28.092	64.754
3	0.710	11.835	76.589						
4	0.548	9.140	85.729						
5	0.491	8.179	93.908						
6	0.366	6.092	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted one factor with a percentage of 50.51%.

The scree plot for ***Experience with m-learning*** is shown in Figure 6. 27.

From the scree plot showed only one component has an eigenvalue above 1 and by observation two or three factors should be considered.

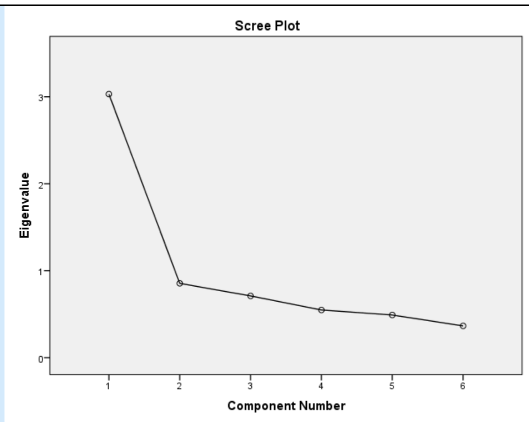


Figure 6.27. Scree plot for experience with m-learning

Table 6. 10. Factor loading and new factors (experience with m-learning)

Factor loading for experience with m-learning			
Factor Loading			New factor(s)
	Component		
	1	2	
I have the knowledge necessary to use m-learning	0.849		Coaching
I would benefit from training on using m-learning	0.745		
I would find m-learning easy to use	0.689	0.438	
Learning using mobile devices is easy for me	0.535	0.482	
A mobile device such as a Smartphone is an educational tool		0.881	Usability
I use m-learning services for exam timetable and exam results	0.403	0.623	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.a a Rotation converged in 3 iterations.			

The six variables were reduced to two factors: ***coaching*** and ***usability.***

6.5.4 What I am enabled to do using mobile devices

This is based on the question ***Using mobile devices for learning enables me to****:* from the survey questionnaire. There were eleven items under the theme *using mobile devices for learning enables me to:*

The values of factorability and reliability are presented in Table 6. 11.

Table 6. 11. Values for factorability and reliability (what I am enabled to do using mobile devices)

What I am enabled to do using mobile devices				
KMO	Bartlett's test of sphericity ~ χ2	df	p-Value	Cronbach's alpha
0.916	1944.379	55	<0.001	0.902

An initial run to obtain eigenvalues for each component resulted in two components having eigenvalues over the Kaiser criterion of 1 and in combination explained 61.93% of the variance in Table 6.12.

Table 6. 12 Kaiser criterion (what I am enabled to do using mobile devices)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.731	52.101	52.101	5.731	52.101	52.101	4.712	42.838	42.838
2	1.081	9.832	61.932	1.081	9.832	61.932	2.100	19.094	61.932
3	0.702	6.385	68.317						
4	0.671	6.100	74.417						
5	0.576	5.235	79.652						
6	0.497	4.519	84.171						
7	0.436	3.961	88.132						
8	0.382	3.475	91.607						
9	0.329	2.991	94.597						
10	0.319	2.902	97.499						
11	0.275	2.501	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted two components with a cumulative percentage of 61.93%.

The scree plot for ***What I am enabled to do using mobile devices*** is explained in Figure 6. 28.

The scree plot shows two factors above the eigenvalue of 1 with possibly three factors to be considered.

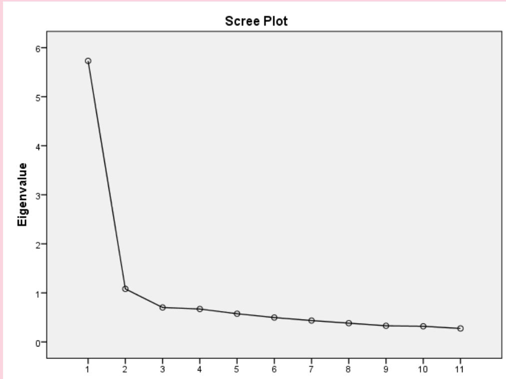


Figure 6.28. Scree plot for what I am enabled to do using mobile devices

Factor loading for the items (what I am enabled to do using mobile devices) and the new factors arising from the EFA are shown in Table 6. 13.

Table 6. 13. Factor loading and new factors (what I am enabled to do using mobile devices)

Factor loading for what I am enabled to do using mobile devices				
Variables	Components			New factor(s)
	1	2	3	
Have a quicker method of getting feedback in learning	0.835			Mobility
Use a more flexible method of learning as it can be done anytime and anywhere	0.767	0.408		
Use "free" time between other activities	0.637	0.409		
Communicate more with my peers	0.536	0.414		
Learn at my own pace		0.815		Personalised learning
Learn when it is convenient for me to learn		0.748		
Learn in a place that is comfortable for me	0.55	0.608		
Share ideas with my peers		0.574		
Access more academic resources	0.494	0.518		
Communicate more with my lecturers			0.856	Increased communication
Share ideas with my lecturers		0.366	0.836	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.a a Rotation converged in 6 iterations.				

Eleven variables were reduced to three factors: ***mobility, personalised learning and increased communication.***

6.5.5 Learning habits

This is based on the question ***Learning habits***, from the survey questionnaire. There were twelve items under the theme *learning habits*. The values of factorability and reliability are presented in Table 6. 14.

Table 6. 14. Values for factorability and reliability (learning habits)

Learning habits				
KMO	Bartlett's test of sphericity ~ χ2	df	p-Value	Cronbach's alpha
0.846	1639.110	66	<0.001	0.803

An initial run to obtain eigenvalues for each component resulted in two components having eigenvalues over the Kaiser criterion of 1 and, in combination, explained 62.44% of the variance Table 6. 15.

Table 6. 15 Kaiser's criterion (learning habits)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.436	36.963	36.963	4.436	36.963	36.963	3.609	30.074	30.074
2	1.779	14.824	51.786	1.779	14.824	51.786	1.947	16.221	46.295
3	1.279	10.654	62.441	1.279	10.654	62.441	1.937	16.146	62.441
4	0.816	6.800	69.241						
5	0.731	6.089	75.330						
6	0.627	5.221	80.551						
7	0.552	4.603	85.155						
8	0.508	4.230	89.385						
9	0.442	3.683	93.068						
10	0.310	2.587	95.655						
11	0.309	2.573	98.228						
12	0.213	1.772	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted three components with a cumulative percentage of 62.44%.

The scree plot for ***Learning habits*** is explained in Figure 6. 29.

The scree plot shows three components with eigenvalues above 1, with possibly four components to be considered.

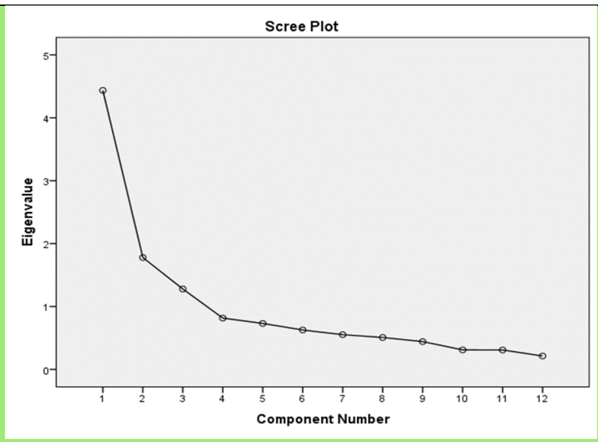


Figure 6.29 Scree plot for learning habits

Table 6. 16 Factor loadings and new factors (learning habits)

Factor loading for learning habits				
Variable	Component			New factors(s)
	1	2	3	
M-learning will lead me to explore the subject matter more	0.855			Dynamic learning
M-learning will bring new opportunities to learning	0.814			
M-learning will make me engage more in my studies	0.804			
M-learning will make learning more fun and enjoyable	0.778			
M-learning will help me understand my study material more	0.761			
With m-learning some students will not do their own work but depend on other students to do their academic work		0.828		Poor learning habits
Using m-learning may increase plagiarism		0.801		
M-learning will disadvantage those students who cannot afford expensive mobile devices		0.556		
I prefer the traditional method of learning where the instructor provides the information		0.481		
M-learning should be incorporated with the traditional method of learning			0.771	Blended learning
M-learning can be used for mainstream education			0.713	
If learning material is made available on mobile devices, I will use my device to access the material			0.680	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.a a Rotation converged in 5 iterations.				

The twelve variables were reduced to three factors: ***dynamic learning, poor learning habits and blended learning.***

6.5.6 When I am using mobile device for studying

This is based on the question ***When I am using my mobile device for studying***, from the survey questionnaire. There were seven items under the theme *when I am using my mobile device for studying*. The values of factorability and reliability are given in Table 6.17.

Table 6. 17 Values for factorability and reliability (experience with m-learning)

When I am using my mobile device for studying				
KMO	Bartlett's test of sphericity ~ $\chi 2$	df	p-Value	Cronbach's alpha
0.754	677.052	21	<0.001	0.717

An initial run to obtain eigenvalues for each component resulted in two components having eigenvalues over the Kaiser criterion of 1 and, in combination, explained 62.5% of the variance in Table 6.18.

Table 6. 18 Kaiser criterion (when I am using my mobile device for studying)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.841	40.583	40.583	2.841	40.583	40.583	2.634	37.632	37.632
2	1.534	21.912	62.495	1.534	21.912	62.495	1.740	24.863	62.495
3	0.706	10.083	72.578						
4	0.604	8.635	81.213						
5	0.548	7.828	89.041						
6	0.431	6.157	95.198						
7	0.336	4.802	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted two components with a cumulative percentage of 62.50%.

The scree plot for ***When I am using my mobile device for studying*** is presented in Figure 6. 30.

The scree plot had two components with eigenvalues above 1, with possibly three components to be considered.

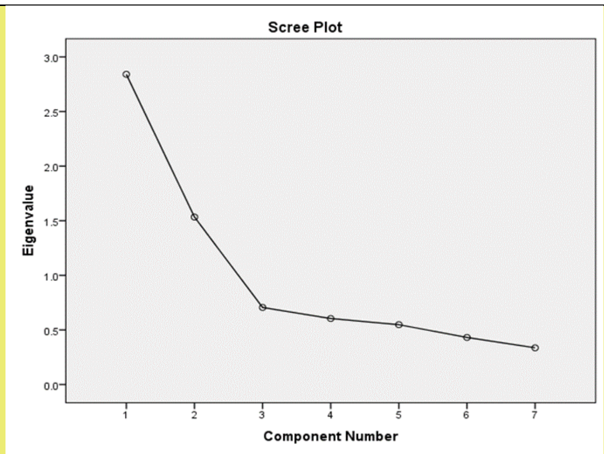


Figure 6.30. Scree plot for when I am using my mobile device for studying

Factor loadings for the items (when I am using my mobile device for studying) and the new factors arising from the EFA are shown in Table 6. 19.

Table 6. 19 Factor loading and new factors (when I am using my mobile device for studying)

Factor loading for when I am using my mobile device for studying			
Variables	Component		New factor(s)
	1	2	
I do not use my mobile device for studying	0.801		Lack of acceptability of m-learning
I forget the academic work I must do	0.789		
I find it is not effective and prefer not to use my mobile device for studying	0.740		
I think mobile devices are for learning other skills (e.g. like cooking, how to fix something) not academic stuff	0.738		
I tend to move to other applications that are not related to what I am studying		0.789	Distraction to academic work
If a message or notification comes through, I go to the message or notification		0.754	
I just focus on my study material, until I am done studying	0.353	-0.695	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.a a Rotation converged in 3 iterations.			

The seven variables were reduced to two factors: ***lack of acceptability of m-learning*** and ***distraction from academic learning***.

6.5.7 My learning style

This is based on the question ***My learning style***, from the survey questionnaire. There were five items under the theme *my learning style*. The values of factorability and reliability are presented in Table 6. 20.

Table 6. 20 Measures for factorability and reliability (my learning style)

My learning style				
KMO	Bartlett's test of sphericity ~ χ2	df	p-Value	Cronbach's alpha
0.600	541.527	10	<0.001	0.520

An initial run to obtain eigenvalues for each component resulted in two components having eigenvalues over the Kaiser criterion of 1 and in combination explained 74.98% of the variance in Table 6. 21.

Table 6. 21 Kaiser's criterion (my learning style)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.144	42.872	42.872	2.144	42.872	42.872	2.117	42.341	42.341
2	1.605	32.106	74.978	1.605	32.106	74.978	1.632	32.637	74.978
3	0.598	11.960	86.939						
4	0.360	7.208	94.146						
5	0.293	5.854	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted 2 components with a cumulative percentage of 74.98%.

The scree plot for ***My learning style*** is presented in Figure 6. 31.

The scree plot shows two components with eigenvalues above 1, with possibly at least 3 components to be considered.

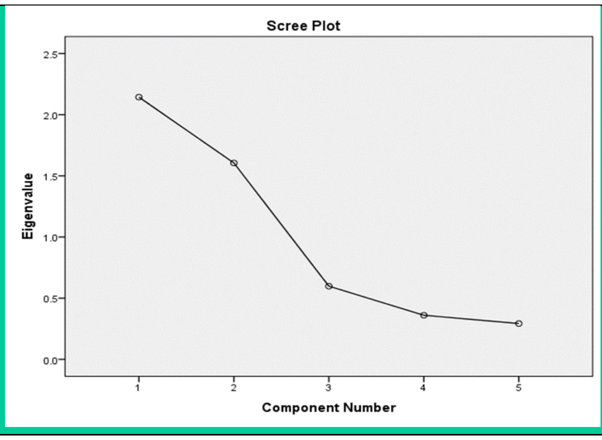


Figure 6.31 Scree plot for my learning style

Factor loading for the item, ***my learning style***, and the new factors arising from the EFA are shown in Table 6. 22.

Table 6. 22 Factor loading and new factors (my learning style)

Factor loading my learning style			
Variable	Component		New factor(s)
	1	2	
In my studies, I am self-disciplined and find it easy to set aside reading and assignment time	0.881		Self-learning
In my studies, I set goals and have a high degree of initiative	0.875		
When it comes to learning and studying, I am a self-directed person	0.754		
I need help setting goals and often study when I see other people studying		0.904	Not ready for independent learning
I prefer to have someone monitor my academic progress by checking on me on a regular basis		0.900	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a] a. Rotation converged in 3 iterations.			

The five variables were reduced to two factors: ***self-learning*** and ***not ready for independent learning.***

6.5.8 Reasons why m-learning can be a challenge to implement

This is based on the question ***Reasons why m-learning can be a challenge to implement***, from the survey questionnaire. There were twelve items under the theme *reasons why m-learning* *can be a challenge to implement*. The values of factorability and reliability are presented in Table 6. 23.

Table 6. 23 Values for factorability and reliability (Why m-learning can be a challenge to implement)

Reasons why m-learning can be a challenge to implement				
KMO	Bartlett's test of sphericity ~ χ2	df	p-Value	Cronbach's alpha
0.834	1233.531	66	<0.001	0.815

An initial run to obtain eigenvalues for each component resulted in two components having eigenvalues over the Kaiser criterion of 1 and in combination explained 49.56% of the variance in Table 6. 24.

Table 6. 24 Kaiser criterion (why m-learning can be a challenge to implement)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.093	34.107	34.107	4.093	34.107	34.107	3.378	28.149	28.149
2	1.854	15.451	49.558	1.854	15.451	49.558	2.569	21.409	49.558
3	0.982	8.185	57.743						
4	0.846	7.051	64.794						
5	0.739	6.155	70.950						
6	0.681	5.679	76.628						
7	0.588	4.896	81.525						
8	0.537	4.476	86.000						
9	0.497	4.141	90.141						
10	0.440	3.666	93.808						
11	0.395	3.288	97.096						
12	0.348	2.904	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted 2 components with a cumulative percentage of 49.56%.

The scree plot for Reasons why m-learning can be a challenge to implement is presented in Figure 6. 32.

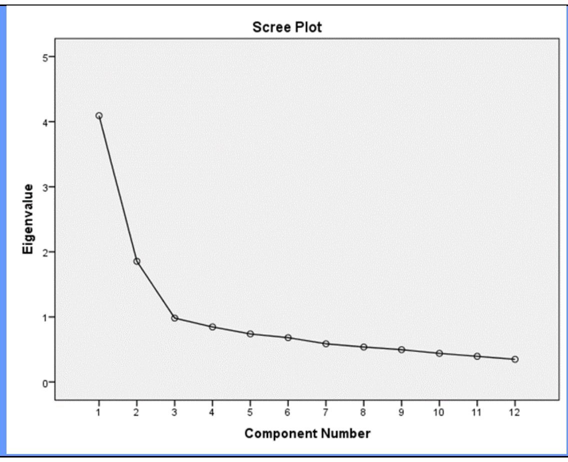
The scree plot has two components with eigenvalues above1, with possibly three components to be considered.	

Figure 6.32. Scree plot for reasons why m-learning can be a challenge to implement

Factor loadings for the items (reasons why m-learning can be a challenge to implement) and the new factors arising from the EFA are shown in Table 6. 25.

Table 6. 25 Factor loading and new factors (reasons why m-learning can be a challenge to implement)

Factor Loading for reasons why m-learning can be a challenge to implement			
Variables	Component		New factor(s)
	1	2	
Data bundles are too expensive for students	0.757		Inadequate connectivity
Poor Internet connectivity (i.e. low bandwidth or slow Internet connections)	0.691		
Most students cannot afford to buy a mobile phone	0.679		
The unavailability of appropriate mobile phones among students	0.677		
It takes too long to access online material from my institution	0.623		
Unreliable electricity supplies	0.529		
Some lecturers are not keen on m-learning	0.49		
Most students prefer using desktop computers for academic work	0.462		
My institution is not supportive of using mobile devices for teaching and learning		0.791	Lack of institutional support
There is no technical support for students when using mobile devices at my institution		0.781	
Mobile devices are not suitable for learning		0.727	
Too many messages or information send from the institution to my mobile device	0.504	0.519	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 3 iterations.			

The twelve variables were reduced to two factors: ***Inadequate connectivity*** and ***Lack of institutional support.***

6.5.9 I would be willing to embrace m-learning for the following reasons or situations

This is based on the question I **would be willing to embrace m-learning for the following reasons or situations**, from the survey questionnaire. There were nine items under the theme

I would be willing to embrace m-learning for the following reasons or situations. The values of factorability and reliability in Table 6. 26.

Table 6. 26 Values for factorability and reliability (Reasons why m-learning can be a challenge to implement)

Reasons why m-learning can be a challenge to implement				
KMO	Bartlett's test of sphericity ~ χ2	df	p-Value	Cronbach's alpha
0.795	944.793	36	<0.001	0.792

An initial run to obtain eigenvalues for each component resulted in two components having eigenvalues over the Kaiser's criterion of 1 and, in combination, explained 54.78% of the variance in Table 6. 27.

Table 6. 27 Kaiser criterion (reasons why m-learning can be a challenge to implement)

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.568	39.650	39.650	3.568	39.650	39.650	2.960	32.886	32.886
2	1.361	15.125	54.775	1.361	15.125	54.775	1.970	21.889	54.775
3	0.950	10.553	65.328						
4	0.764	8.486	73.814						
5	0.658	7.311	81.124						
6	0.559	6.214	87.338						
7	0.447	4.965	92.303						
8	0.379	4.209	96.512						
9	0.314	3.488	100.000						
Extraction Method: Principal Component Analysis.									

SPSS v26 extracted two components with a cumulative percentage of 54.78%.

The scree plot for I will be willing to embrace m-learning for the following reasons or situations is explained in Figure 6.33.

The scree plot shows two components with eigenvalues above 1, and possibly three components to be considered.

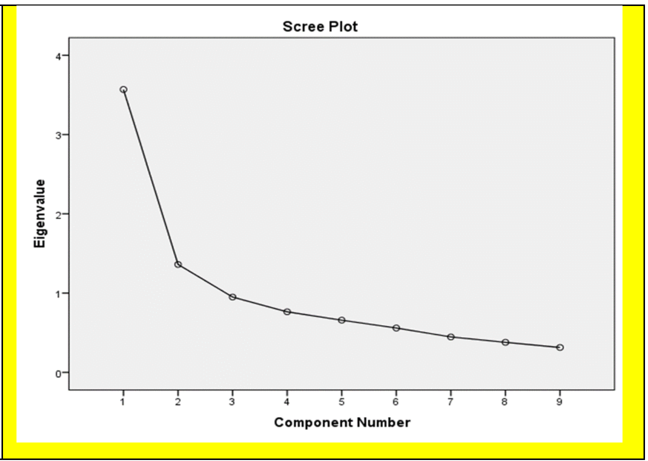


Figure 6.33 Scree plot for I would be willing to embrace m-learning for the following reasons or situations

Factor loading for the items (I would be willing to embrace m-learning for the following reasons or situations) and the new factors arising from the EFA are shown in Table 6. 28.

Table 6. 28 Factor loading and new factors (I would be willing to embrace m-learning for the following reasons or situations)

Factor loading: I would be willing to embrace m-learning for the following reasons or situations				
Variables	Component			New factor(s)
	1	2	3	
If there was a provision for cheaper data bundles for students	0.846			Affordability
If I am provided with a suitable mobile device	0.830			
I can fast-forward or rewind audio and video content	0.582			
I can collaborate with other students	0.552	0.447		
It is easier to communicate behind the screen, unlike face-to-face communication		0.789		Acceptability of m-learning
I am always on my mobile device and if learning material was available on it, that would mean I engage with my learning content more	0.408	0.664		
I already use some form of m-learning informally and would like it done more formally	0.436	0.583		
If my peers were interested in it			0.894	Social pressure
If my lectures were keen on using it			0.886	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a] a. Rotation converged in 5 iterations.				

The nine variables were reduced to three factors: (1) ***affordability*** (2) ***Acceptability of m-learning*** (3) ***Social pressure.***

6.6 Factor loading and relation to current model

Factor loadings for the data set with the corresponding new factors are shown in Table 6. 29. Table 6. 29 gives details of how the factors from EFA relate to the current model in the previous chapter, and reveals new sub-themes that are not present in the current model. As discussed in section 3.13.4 variables that had cross-loading were discarded, any variable which show cross-loadings in table 6.29 was not considered in the new factor.

Table 6. 29 Factor loading for data set and how this relates to the current m-learning model

Factor Loading					**Relation to current model**	
	1	**2**	**3**	**New Factors**	**Confirmed theme from model**	**New Sub-theme From EFA**
I experience unreliable Internet connection	0.823			Connectivity issues	M-learning characteristics	
The Internet connection on my mobile is of low speed	0.792					
The small keypad and screen size are a limitation for me to use a mobile device for learning	0.747					
Using a mobile device for learning is a problem for me because of the limited memory and battery capacity	0.687					
I find it hard to navigate and download educational material using a mobile		0.891		Performance issues	M-learning issues	
I struggle to keep the battery for my mobile device charged		0.858				
I use m-learning services to check my academic calendar	0.895			Notification reminder		Notification reminder
I use m-learning services for alerts and warnings	0.791					
I use m-learning service for course registration and time table	0.747	0.401				
I have the knowledge necessary to use m-learning	0.849			Coaching	M-learning charactersitics	
I would benefit from training on using m-learning	0.745					
I would find m-learning easy to use	0.689	0.438				
Learning using mobile devices is easy for me	0.535	0.482				

Learn at my own pace		0.815		Personalised learning		
Learn when it is convenient for me to learn		0.748				
Learn in a place that is comfortable for me	0.55	0.608				
Share ideas with my peers		0.574				
Access more academic resources	0.494	0.518				
M-learning will lead me to explore the subject matter more	0.855			Dynamic learning	Pedagogy	
M-learning will bring new opportunities to learning	0.814					
M-learning will make me engage more in my studies	0.804					
M-learning will make learning more fun and enjoyable	0.778					
M-learning will help me understand my study material more	0.761					
With m-learning some students will not do their own work but depend on other students to do their academic work		0.828		Poor learning habits		
Using m-learning may increase plagiarism		0.801				
M-learning will disadvantage those students who cannot afford expensive mobile devices		0.556				
M-learning should be incorporated with the traditional method of learning			0.771	Blended learning	M-learning characteristics	
M-learning can be used for mainstream education			0.713			
If learning material is made available on mobile devices, I will use my device to access the material			0.680			
I do not use my mobile device for studying	0.801			Lack of acceptability of m-learning	Factors influencing m-learning adoption	
I forget the academic work I must do	0.789					
I find it is not effective and prefer not to use my mobile device for studying	0.740					
I think mobile devices are for learning other skills (e.g. like cooking, how to fix something) not academic stuff	0.738					
I tend to move to other applications that are not related to what I am studying		0.789		Distraction from academic work	M-learning issues	
If a message or notification comes through, I go to the message or notification		0.754				
In my studies, I am self-disciplined and find it easy to set aside reading and assignment time	0.881			Self-learning	M-learning characteristics	
In my studies, I set goals and have a high degree of initiative	0.875					
When it comes to learning and studying, I am a self-directed person	0.754					

I need help setting goals and often study when I see other people studying		0.904		Not ready for independent learning		Not ready for independent learning
I prefer to have someone monitor my academic progress by checking on me on a regular basis		0.900				
Data bundles are too expensive for students	0.757			Inadequate connectivity	M-learning characteristics	
Poor Internet connectivity (i.e. low bandwidth or slow Internet connections)	0.691					
Most students cannot afford to buy a mobile phone	0.679					
The unavailability of appropriate mobile phones among students	0.677					
It takes too long to access online material from my institution	0.623					
Unreliable electricity supplies	0.529					
My institution is not supportive of using mobile devices for teaching and learning		0.791		Lack of institutional support	Factors influencing m-learning adoption	
There is no technical support for students when using mobile devices at my institution		0.781				
Mobile devices are not suitable for learning		0.727				
Too many messages or information send from the institution to my mobile device	0.504	0.519				
If there was a provision for cheaper data bundles for students	0.846			Affordability	M-learning challenges	
If I am provided with a suitable mobile device	0.830					
If my peers were interested in it			0.894	Social pressure		Factors influencing m-learning adoption
If my lectures were keen on using it			0.886			

6.7 Themes emerging from survey

From the current m-learning model developed this far based on the literature review, and interviews and focus group discussions, the five main themes are: (1) m-learning issues), (2) m-learning challenges, (3) factors influencing m-learning adoption, (4) pedagogy, and (5) m-learning characteristics. From the survey, after EFA, the factor loading confirmed all five themes and two new sub-themes that had not previously been part of the model. The three sub-themes emerging from the EFA are:

- Notification reminder
- Not ready for independent learning

The confirmed themes are discussed in more detail under the various sub-themes below.

6.7.1 M-learning issues

Two sub-themes were confirmed by the survey under the main theme, M-learning issues. The two sub-themes are performance issues and distraction from academic work.

6.7.1.1 Performance issues

The factor, performance issues, in the survey related to items such as limited memory, limited battery and problems with navigation on mobile devices. These items relate to device issues discussed in section 2.11.2. These findings further support earlier findings from focus group discussions that device issues can affect m-learning implementation and adoption (section 5.3.6.2). These findings on issues of small screen size are consistent with the literature, although with advancements in technology, mobile devices have better performance, having more memory and longer battery life (Al-Adwan, Al-Madadha and Zvirzdinaite 2018; Ally and Wark 2018; Crompton and Burke 2018; Toperesu, Van Belle and Turpin 2019). Learners require suitable mobile devices in order to fully utilise the m-learning mode.

6.7.1.2 Distraction from academic work

From interviews as discussed earlier distraction was mentioned as a concern regarding m-learning. Some key stakeholders (staff, faculty heads and lecturers) are apprehensive about distraction from academic work when utilising mobile technologies (chapter 4). Similarly, students during the focus group discussions while supportive of m-learning were concerned about how the use of mobile technologies could easily lead to diversions from academic work (chapter 5). From the survey learners strongly indicated that messages coming through mobile devices were a source of distraction. Learners also shared that they moved to unrelated apps when using mobile technologies for studying. The matter of distractions from academic work with m-learning continues to be discussed in literature (Toperesu, Van Belle and Turpin 2019; Kaliisa, Palmer and Miller 2019; Ajayi, Ayo and Olamide 2019). Results from the survey match the qualitative data obtained earlier in this study through interviews and focus group discussions.

6.7.2 M-learning challenges

The main challenges to emerge from the EFA were the issues of infrastructure, affordability and lack of institutional support.

6.7.2.1 Infrastructural challenges

Through the survey, learners indicated that some connectivity issues they experienced were the unreliable Internet connections and the poor quality of Internet connections on their mobile devices. Poor Internet connectivity was also attributed to inadequate infrastructure. There was high factor loading on items of low bandwidth, unreliable electricity supplies and the time it takes to access online material from universities. Connectivity issues were also linked to data cost as learners argued that data bundles are expensive for learners. This means that without sufficient financial resources, some learners will not be able to access the Internet.

These findings further confirm the findings from the focus group discussions that Internet access was a challenge attributed to poor infrastructure and unreliable power supplies as discussed in section 5.3.6.1. The earlier interviews also widely covered the issue of poor Internet connectivity, indicating that it hampers the m-learning implementation and adoption as discussed by the library staff, faculty heads, lecturers and IT support staff (section 4.3.6.1, section 4.4.7.1, and section 4.5.10.1). There are suggestions that the requisite infrastructure would need to be in place for m-learning to be successful. The need for good network connectivity for m-learning to take place has been highlighted in the literature, particularly when implementing BYOD (Welsh et al. 2018). Internet connectivity issues have been reported in all parts of the world although this problem seems to be predominant in Africa.

Africa has the lowest level of international connectivity of all regions, with Asia and the Pacific regions taking the lead in both fixed broadband and mobile broadband in the developing economies (International Telecommunication Union 2018). African universities are faced with financial constraints which make it difficult for these institutions to pay for quality services and infrastructure required for m-learning (Ghasia et al. 2018). Reports of unstable Internet connectivity have emerged from Indonesia, Malaysia, Laos and Philippines (Churchill, Pegrum and Churchill 2018), with the practical issue of poor electricity supplies also reported from Indonesia. Effective mobile learning will require adequate infrastructure that facilitates stable and high-speed Internet connectivity. There is evidence of some infrastructure put in place for m-learning, but it needs to operate efficiently and consideration needs to be given to necessary upgrades given the financial constraints in countries like Zimbabwe.

6.7.2.2 Affordability

The affordability of mobile devices appears to be a significant obstacle to m-learning implementation and adoption. The items that loaded on the factor, affordability, were related to the cost of Internet access and the cost of devices. Learners responded to survey questions with suggestions that they would be willing to embrace m-learning on condition that there were cheaper data bundles and the provision of appropriate mobile devices. It may be that learners have mobile devices but they feel the devices they own are not suitable for m-learning. Learners earlier in the study via focus groups suggested that the lack of affordability of devices and data bundles was an obstacle to m-learning adoption in section 5.3.6.3.

In the focus group discussions, learners argued that Internet access was very expensive in Zimbabwe compared to other countries with suggestions that there be provision for subsidised rates for learners. Students in the focus group discussions maintained that suitable phones were out of reach price-wise as some phones suitable for m-learning were expensive. Concerns about the affordability of mobile devices were echoed by library staff (section 4.3.6.4) and lecturers during the interviews (section

4.5.10.2). These survey findings on affordability which are corroborated by earlier findings from the interviews and focus groups, are rather unsurprising given the non-uniform financial endowments among students and the current socio–economic situation in Zimbabwe. These findings of the current study are also in tandem with previous studies from comparable developing countries, namely Uganda and Nigeria which report that mobile devices are pricey for learners; thus, not all tertiary students have devices appropriate for m-learning (Kaliisa, Palmer and Miller 2019; Ajayi, Ayo and Olamide 2019).

However, in developed countries, appropriate mobile devices amongst learners may be more pervasive. There seems to be a great inconsistency regarding access to appropriate mobile devices for learners in some developing countries and learners from developed countries. Learners in Canada reported that the quality of the device was more important than the cost (Wardley, Carter and D'Antonio 2018). This seems to suggest that cost is not necessarily an issue. Again, in Canada, a survey of four universities show that 92.6% of the learners owned a mobile device with Internet access (Boruff and Storie 2014). Similarly, in Australia, according to Farley et al. (2015) more than 95% of students own a suitable mobile device. Suitable mobile devices may be pervasive in developed countries; however, in Zimbabwe learners have raised concerns that m-learning may not be inclusive because some students will not have access to the appropriate devices.

6.7.2.3 Lack of institutional support

Questions which referred to some issues emanating from the institution were loaded under 'lack of institutional support'. The four items that loaded under this factor were based on the following issues: (1) too many messages send from my institution; (2) mobile devices are not suitable for learning; (3) there is no technical support for students when using mobile devices; and (4) my institution is not supportive of using mobile devices for teaching and learning.

Faculty heads discussed the need for management support for m-learning in institutions of higher learning (section 4.4.7.3). Faculty heads also reported the need for technical support and resources. Lecturers highlighted the need for institutional support in the form of responsive technical support, training, adequate bandwidth at institutions (section 4.5.10.3) and IT staff support reported that the number of technical support staff could be increased (section 4.6.4.2). These findings mirror the findings of Osang, Ngole, and Tsuma (2013) who reported the lack of institutional support as a challenge to m-learning implementation. Some studies assert that institutional support can impact m-learning implementation (Okai-Ugbaje, Ardzejewska and Ahmed 2017; Alrasheedi and Capretz 2018) with O'Doherty et al. (2018) concluding that institutional support is of the utmost importance when integrating technology with learning. Without institutional support, it may be more challenging to successfully implement m-learning; thus, m-learning initiatives that lack institutional support are not likely to be successful.

6.7.3 M-learning characteristics

Under the theme, m-learning characteristics, several of the sub-themes were further confirmed through EFA.

6.7.3.1 Increased access

There was high factor loading on how learners could use some mobile learning services in relation to their learning. The services used by students included watching educational videos, listening to audio lectures and getting soft copies of study material. It is evident that m-learning opens up more academic resources for learners. These findings reflect those of the focus group discussions in which learners shared that m-learning removed complete reliance on the instructor and opened up a variety of educational resources such as YouTube videos (section 5.3.5.3). Interviews with library staff (section 4.3.7.3) and faculty heads (section 4.4.5.3) also found that m-learning increased access to educational resources for learners from local to global content. Students from Nigeria and Uganda reported that the use of mobile technologies increased access to educational resources, through the sharing of resources, increased access to course material, and having full access to learning resources at any given time (Osang, Ngole and Tsuma 2013; Asiimwe and Grönlund 2015). M-learning opens up opportunities to access various educational resources, and access to these resources can be further enhanced by the collaboration of learners. Access to learning material is further enhanced with a variety of ways learners can interact with learning resources which include audio, text and video clips.

6.7.3.2 Training

The components of the factor, coaching, included items on the experiences that learners had with m-learning. The items included student opinions on whether learners had the requisite knowledge to use m-learning, whether learners would benefit from training on using m-learning, and whether learners would find m-learning easy to use. Training on m-learning may possibly involve how mobile technologies can be perceived as more than a communication device but also an educational tool. Training may provide an opportunity to address issues of distraction i.e. how the benefit of appropriately using mobile technologies may outweigh the concerns of distraction from academic activities which calls on self-discipline. Training may also encourage learners to utilise m-learning informally and expand students' learning.

During interviews, lecturers echoed similar sentiments on the need for training. Some lecturers felt that they, more so than students, need training for m-learning. Lecturers discussed the various types of training they needed (section 4.5.10.4), and some lecturers felt that students should be trained on appropriate use of mobile technologies, or some sort of induction on using mobile technologies for academic purposes. In the focus group discussions, students felt instructors needed to be well trained so they can be more effective in integrating mobile technologies with education (section 5.3.7.2).

It is encouraging that the findings in this study support previous studies that report the need for training when using the m-learning mode. Kaliisa, Palmer, and Miller (2019) suggest that educators should consider training prior to m-learning integration and draw examples from Australia and Africa where m-learning training has been conducted for university students. Ajayi, Ayo, and Olamide (2019) recommend training for instructors and students and also consider the practical aspect associated with the cost of training instructors and students which can be a challenge to m-learning implementation. The National Taiwan Normal University (NTUN) has developed an efficient m-learning and teaching system which they share with teachers and provide workshops and teacher training on how to make good use of the system in facilitating their teaching (Churchill, Pegrum and Churchill 2018). Although learners and students alike are capable of using mobile technologies, it is likely that training on how to use these technologies in teaching and learning may improve the teaching and learning process.

6.7.3.3 Mobility

This factor was made up of components that took advantage of the portability of mobile technologies and the mobility of the learner. The components of this factor included use of "free time" between activities, communication with peers, a more flexible method of learning as learning occurs anytime anywhere and a quicker method of getting feedback on learning. These findings are in line with the findings from the focus group discussions. In the focus group discussions, learners observed that learning could occur at any place and that portability of mobile technologies enabled learners to access learning material from any location (section 5.3.5.1). Lecturers observed that the portability of mobile technologies was advantageous for both learners and instructors as learning would no longer be constrained to specific locations or limited to specific times (section 4.5.7.3).

The portability of mobile devices coupled with mobile learners makes learning mobile, as learners acquire knowledge inside and outside the lecture rooms through a combination of modes such as text, voice, image and touch (Barden 2019). This study focuses on the m-learning definition that is centred on the mobility of the learner.

6.7.3.4 Personalised learning

Items that loaded under the factor, personalised learning, were related to the way that learners perceived how they could utilise mobile technologies in their learning. The factors with the higher values included 'learn at my own pace', 'learn when it is convenient for me to learn', 'learn in a place that is comfortable for me'. Other components with lower values were 'access more academic resources' and 'share ideas with my peers'.

Comparison of these findings with the focus group discussion findings confirms that learners are keen on personalised learning. In the focus groups, learners discussed the convenience of utilising mobile technologies, mentioning that learning would not be restricted to a particular location, thus saving travelling costs (section 5.3.5.1). The faculty heads during interviews were in agreement, asserting that m-learning would enable personalised learning as students learn at their own pace (section 4.4.5.2). Similarly, some lecturers pointed out that learning would be continuous and not confined to institution walls as learners access course material from anywhere and at a time suited to the learners (section 4.5.7.3).

There are recommendations for more effective practices to support personalised learning (Burden et al. 2019; Chiu and Huang 2016), with a call for a "culture shift" from academics to transition from traditional approaches to teaching and learning to embracing approaches that are open and participatory (Johnson et al. 2013). In their study Johnson et al. (2013), note that the challenges are finding a balance between students' connected and unconnected lives in Higher Education and providing a holistic education that is mindful of this type of learner. Ng'ambi et al. (2016) claim that these challenges are ongoing in the African context of higher education. It is encouraging that faculty heads and lecturers seem to be receptive of personalised learning in Zimbabwe higher education. This may be evidence of the "culture shift" within academia, indicating that African academics are becoming more inclined favour a more open and participatory approach in higher education.

6.7.3.5 Blended learning

The factor, blended learning, comprised three components that were related to students' learning habits. The items that made up these components were based on students' opinions about m-learning being incorporated with traditional approaches to teaching and learning, whether learners were willing to access learning resources using their mobile devices, and whether m-learning could be used in mainstream education.

During focus group discussions, students raised concerns about the huge transition from traditional approaches of teaching and learning to m-learning. A major issue was that some learners were uneasy about not having an instructor in front of them. It is likely that learners would appreciate m-learning as supplementing the traditional approaches, and that such reassurances would make learners embrace m-learning more.

Unsurprisingly, lecturers and faculty heads, as reported in the interviews, are keen on using mobile technologies for blended learning. The academics seem to have a better appreciation of how m-learning would be used in conjunction with the traditional approaches of teaching and learning (sections 4.4.5.4 and 4.5.9).

There are suggestions that blended learning can harness the transformational potential of mobile technologies in higher education while coping while addressing some of the shortcomings of m-learning (Kearney et al. 2012; Zhou and Li 2019; Hou et al. 2014). Learners need to understand that m-learning is not a substitute for the traditional approaches to teaching and learning. Rather, it complements the traditional approaches to teaching and learning and improves the teaching and learning experience of both the instructor and learners.

6.7.3.6 Self-learning

Another m-learning characteristic confirmed by the EFA is self-learning, with an opposing factor also emerging from EFA - not ready for independent learning.

Focus group discussions among students yielded mixed views on self-learning as shown in Figure 6. 34. Some learners expressed confidence in their self-learning, while others felt strongly that they needed more direction and guidance (section 5.3.7.1).

The ***self-learning*** factor was made up of three components. The items that made up this factor considered the learning styles of students. The items were based on learners' perceptions of how they learn, the questions from the survey required responses on the level of agreement on where learners placed themselves in terms of:

- Self-direction.
- Self-discipline.
- If learners considered themselves as having a high degree of initiative in their learning.

The factor ***not ready for independent learning*** was made up of two components. The items that made up this factor considered the learning styles of students. The items were based on learners' perceptions of how they learn, the questions from the survey required responses on the level of agreement on where learners placed themselves in terms of:

- I need help setting goals and often study when I see other people studying
- I prefer to have someone monitor my academic progress by checking on me on a regular basis.

Figure 6.34 Views on self-learning (by researcher)

Lecturers had diverse views about self-learning. During the interviews, some lecturers expressed concerns that the calibre of their current students made them insufficiently ready for self-learning. Some lecturers expressed that m-learning would benefit only a handful of those learners who were already self-learners, as most of the students needed constant guidance and supervision (section 5.3.7.1). It is possible that learners in Zimbabwe tertiary institutions are seen as requiring constant guidance and supervision because the traditional approaches to teaching and learning have made them overly dependent on their lecturers. The promotion of a different viewpoint that recognises the current learner who has a connected life, and working on a "culture shift" as suggested by Johnson et al. (2013), could result in a different approach to teaching and learning that could also develop students as autonomous learners. Mobile technologies can affect students' learning autonomy (Fu 2018). Mobile technologies stimulate independent thinking and self-learning (Chou et al. 2019). Self-learning can be impacted by m-learning, and it can certainly be improved through m-learning as learners look for relevant resources. Therefore, even learners who may not be independent learners may gradually become more independent as they make use of m-learning.

6.7.4 Factors influencing m-learning adoption

Factors that influence m-learning adoption emerging from EFA are usability, m-learning acceptability and social pressure.

6.7.4.1 Usability

The factor usability was made up of two components. The components were drawn from learners' experiences with m-learning. The items from the survey questionnaire considered (1) whether learners perceived mobile devices as educational tools and (2) the use of m-learning for exam related issues. It would not be surprising that nowadays learners perceive mobile devices such as smartphones as educational tools, given that most of these learners make use of these technologies on a daily basis for other informational needs. The use of these devices would almost come naturally to most of the young learners as they start using these mobile devices earlier on in life. From the descriptive statistics less than 2% of university students had used a mobile device for less than one year, with the rest having have used a mobile device for at least a year.

Naturally, the usability of mobile devices according to the focus group data, shows that most tertiary students find mobile technologies easy to use and do not require technical support when using mobile devices (section 5.3.4.3). With the exception of IT support staff and the students, none of the other stakeholders discussed usability. The IT support staff in agreement with the students, did not report any issues regarding the usability of mobile technologies. As mentioned earlier, usability is not widely covered when considering the technological aspects of m-learning; it is identified as one of the several facilitating aspects of mobile technologies (Ali et al. 2015). A strength for mobile applications lies in the user interface usability, meaning the interface should be easy to navigate (Navarro et al. 2016).

Usability is likely to play a significant role, particularly where m-learning is in its infancy and when learners are yet to become accustomed to using mobile devices as learning tools.

6.7.4.2 M-learning acceptability

The EFA gave rise to two factors on whether or not m-learning is well received. These factors have been named ‘m-learning acceptability’ and ‘lack of acceptability’ as shown in Figure 6.35.

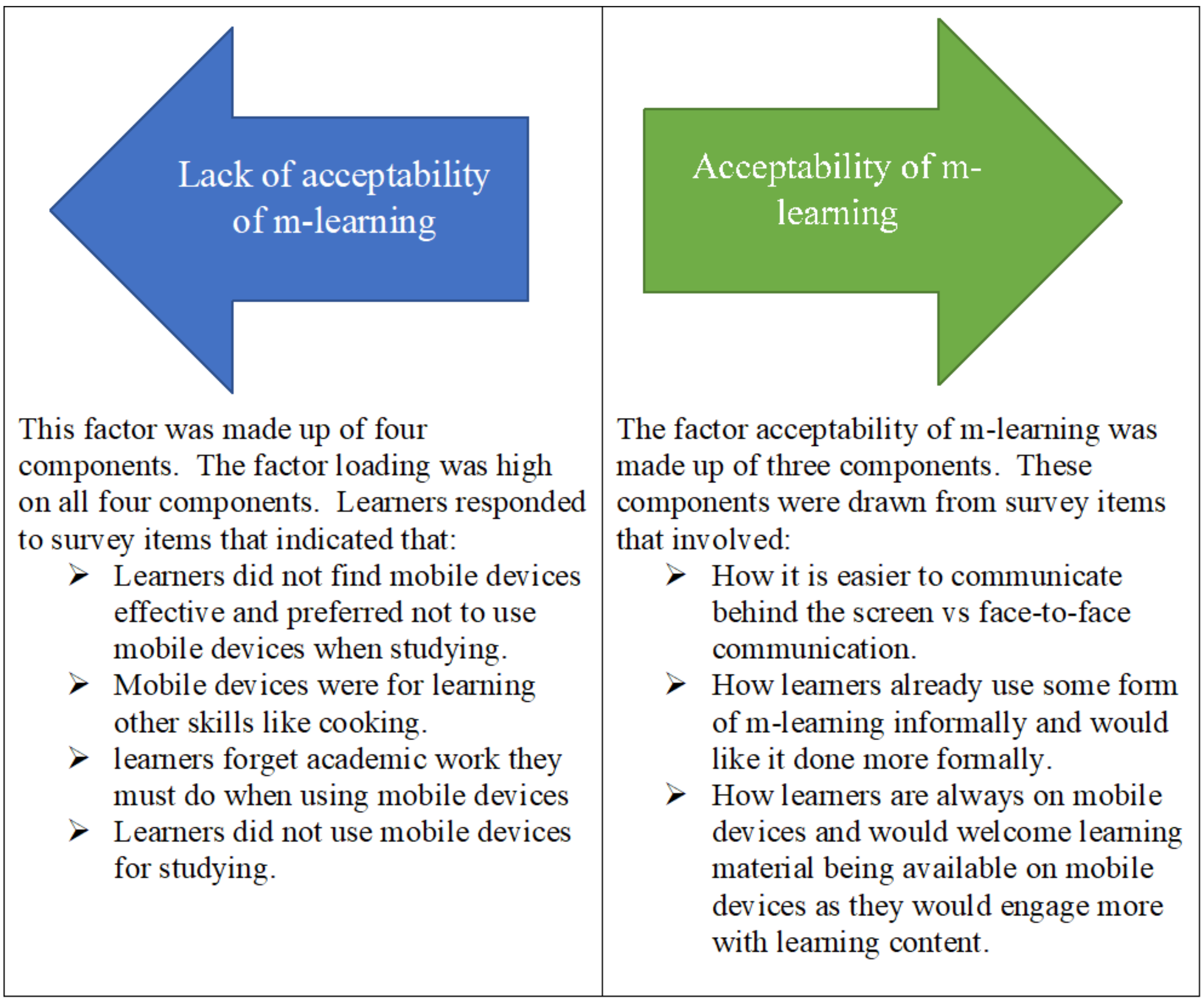


Figure 6.35 Views on m-learning acceptability (by researcher)

M-learning acceptance based on the focus discussion groups hinges on four aspects: (1) several m-learning characteristics, (2) experience with m-learning, (3) willingness to embrace m-learning and (4) readiness to adopt m-learning (section 5.3.7.7). In the focus group discussions, opinions on m-learning acceptance were divided. In the same vein it was noted that m-learning acceptance was not unanimous among faculty heads and lecturers. Some lecturers stated outright that they were not keen to embrace m-learning yet (section 4.5.8.4). For some lecturers, acceptability hinges on the availability of resources, while for others it has more to do with their academic domain. Mixed views on m-learning acceptance were expressed by learners, lecturers and faculty heads with various reasons for reservations about embracing m-learning. It is possible that workshops and training on m-learning may dispel some reservations held by the stakeholders, and the provision of adequate infrastructure would reassure them.

6.7.5 Pedagogy

Under the main theme, pedagogy, the factors that emerged are dynamic learning and poor learning habits.

6.7.5.1 Dynamic learning

The components that loaded under the factor, dynamic learning, related to questions about learning habits. The individual components that loaded under this factor were: (1) would make learning more fun and enjoyable (2) lead learners to further explore subject matter (3) bring new opportunities to learning (4) make learners engage more in studies and (5) will help learners understand study material. These findings accord with earlier findings in the focus group discussions where students reported that m-learning made learning more engaging (section 5.3.5.2) and that access to various academic sources made concepts easier to understand (section 5.3.5.3). Use of mobile devices in education offers dynamic learning activities allowing learners to experience various channels of interactions with learning (Buchholz et al. 2016; Yousafzai et al. 2016). Integrating mobile technologies with education changes the teaching and learning landscape, opening up more resources which are more interactive and also allow collaboration, which makes learning livelier.

6.7.5.2 Poor learning habits

The factor, poor learning habits, was loaded with three components. These components referred to issues related to learning habits. The components were: (1) m-learning may increase plagiarism (2) with m-learning some students will not do their own work but depend on others and (3) m-learning will disadvantage learners who cannot afford mobile devices. These components indicate unethical learning habits that are also not inclusive.

Earlier findings from the focus group discussions are supported here; learners argued that m-learning would not be inclusive as some learners could not afford the appropriate mobile devices (section 5.3.6.3). Learners expressed concern about the quality of learning, mentioning plagiarism and cheating (section 5.3.7.3). Library staff remarked on the digital divide that could arise as some students could not afford devices, as well as the digital divide due to the varying degree of sophistication among mobile technologies (section 4.3.8.4). Similar sentiments about plagiarism were also expressed by library staff (section 4.3.8.3) and lecturers (section 4.5.10.3). Some shortcoming of m-learning discussed the in literature include plagiarism, cheating, and procrastination (Muhammad et al. 2016; O'bannon and Thomas 2014). However, m-learning is not just about data-driven content but opportunities to collaborate as well as learn on the go. There is a need to educate learners and students alike on the benefits of m-learning that are not necessarily content-driven but also the multiple diverse ways to interact with learning material and peers to expand learning.

6.8 Contrasting sub-themes

EFA shows that self-learning is a sub-theme that emerged under the main theme m-learning characteristics which is a contrast to not being ready for independent learning (section 6.7.3.6). Similarly, two other contrasting new factors after EFA are acceptability of m-learning under factors influencing m-learning adoption and lack of m-learning acceptability (section 6.7.4.2). The four factors were observed to have high loadings. These dichotomies indicate that while some learners are ready for self-learning, others are not; and while some learners are ready to embrace m-learning, others are yet to warm to the idea of using this mode of learning.

A refined model will seek to accommodate the dichotomies presented by EFA. As a result, a new theme is required that takes into consideration the contrasting themes of acceptability and self-learning. The researcher revisited the model presented in the previous chapter and considered how the contrasting themes of acceptability and self-learning could be accommodated in the m-learning model. The researcher analysed the existing themes which gave rise to a new theme, which meant another modification of the m-learning model.

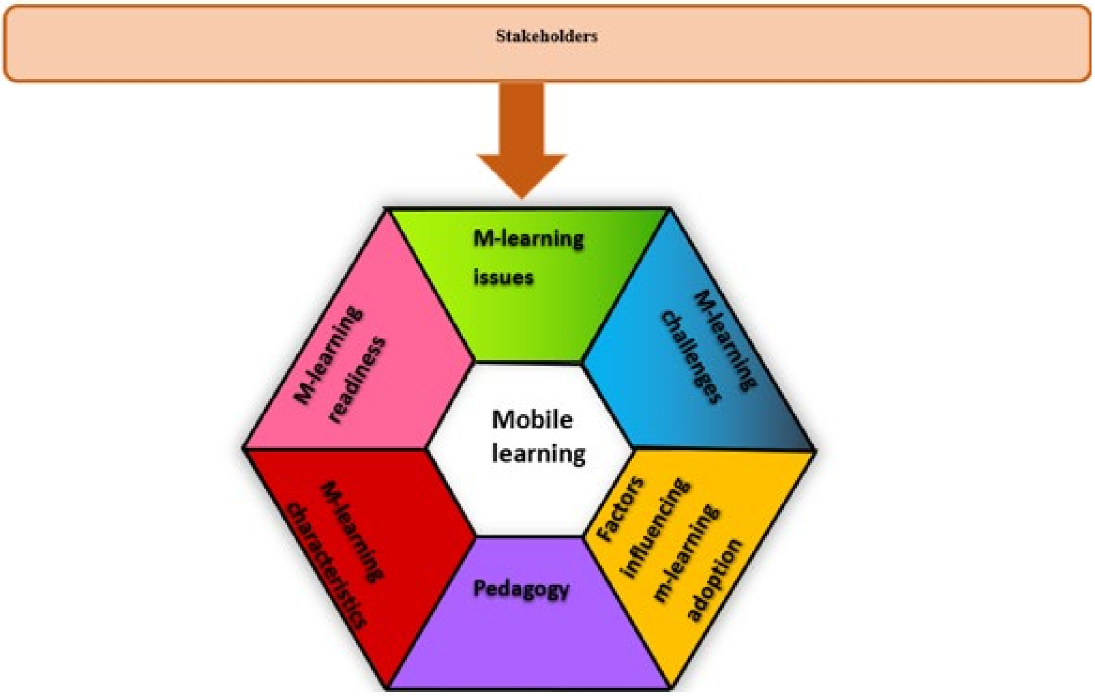
6.9 New theme

The new theme emerging (from EFA and considering the previous refined model) was identified as **m-learning readiness**. This theme takes into consideration the contrasting factors presented after EFA and additional themes from the most recent m-learning model from chapter 6. The sub-themes under m-learning readiness are listed below:

- Training
- Institutional support
- Acceptability
- Lack of acceptability
- Self-learning
- No ready for independent learning
- Policy

6.10 Refined model

The model was refined to incorporate the findings of the survey which incorporates the new theme. The refined model is presented in Figure 6.36.



M-learning readiness	M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning Characteristics
❖ ***Training**** *moved from m-learning characteristics)* ❖ ***Institutional support**** *moved from factors influencing m-learning adoption)* ❖***Acceptability of m-learning****(moved from factors influencing m-learning adoption)* ❖ ***Lack of acceptability of m-learning*** ❖***Self-learning*** *(moved from m-learning characteristics)* ❖***Not ready for independent learning***	❋ Distraction to academic work ❋ Device issues ❋ Privacy ❖ poorly regarded	ʘ Infrastructure ʘ Cost of infrastructure ʘ Policies ❋ Unsuitable mobile devices ❖ Affordability ❖ Instructors not ready ❖ Inequality and lacks inclusivity	ʘ Cheaper mobile phones ʘ Culture ʘ Usability ʘ HCI ❋ Affordability of mobile devices Mobile devices more accessible than laptops or PCs ❋ Advance STEM ❋ Institutional support ❋ Acceptability of m-learning ❖ Mobile device accessibility and suitability ❖ ***Social pressure***	ʘ What constitutes learning? ʘ Learning theories ʘ Stakeholders' expectations ❋ Dynamic learning ❋ Self-learning ❖ Poor learning habits ❖ Huge transition from traditional face-to-face mode ❖ Reduced quality of learning ❖ Leads to procrastination	ʘ Connectivity ʘ Ubiquity ʘ Mobility ʘ Training & support ʘ Collaboration ʘ Blending ❋ Increased access ❋ Convenience ❋ Flexibility ❋ Self-learning ❋ Personalised learning ❖ *Increased engagement* ❖ Self-learning

Figure 6.36 M-learning model after survey

6.11 Conclusion

The survey participants were representative of the general population of Zimbabwe in terms of gender. Participants were drawn from a variety of main fields of study. The majority of tertiary students in Zimbabwe are below 40 years of age with access to a variety of mobile devices. The results clearly show the kinds of resources learners would like to access using mobile devices. The data set was suitable for EFA and was checked for reliability. EFA confirmed all themes in the final m-learning model created in the previous chapter and gave rise to new sub-themes. There were contrasting themes from the EFA on m-learning acceptability and self-learning which were not surprising as similar findings were found with the qualitative analysis. While some of the stakeholders are ready to embrace m-learning, others are rather hesitant. When it comes to self-learning, again some students are not ready for autonomous learning, while others believe that learners in Zimbabwe are ready to learn with some degree of independence. To address this in the m-learning model, a new theme emerged, **m-learning readiness,** which accommodates these opposing views in addition to other aspects that can make Zimbabwe tertiary institutions more prepared for m-learning on a larger scale. The refined model above evolved from the initial model based on the literature review, which was then modified after the analysis of interview data. Another modification was made after the focus group discussions, and the most recent modification was made after the survey data analysis. This thesis demonstrates that that there are six aspects to m-learning implementation in Zimbabwe higher education: (1) m-learning challenges (2) m-learning characteristics (3) factors influencing m-learning adoption (4) pedagogy (5) m-learning issues and (6) m-learning awareness. Chapter 7 concludes this thesis by providing an overview of the findings, research contributions, research limitations and avenues of future research.

Chapter 7

7. Conclusion

7.1 Introduction

The previous chapter presented the final phase of the research which was the quantitative phase, and the analysis of the quantitative data using SPSS software (version 26). This chapter presents the outcomes of this study comprised of the findings of each phase which led to the m-learning model for Zimbabwe tertiary institutions.

This study set out to explore the concept of m-learning in higher education settings in Zimbabwe. The study identified the extent to which the various stakeholders were prepared to accept mobile technologies as learning tools. It evaluated the perceptions and attitudes of the various stakeholders in regard to m-learning in an effort to increase the chances of successful m-learning implementation. The study also assessed whether students are prepared and willing to embrace m-learning. Most literature on m-learning implementation and adoption originates from developed countries; moreover, the cultural biases of m-learning are predominantly from Western countries. It is imperative to address various issues of m-learning specifically in terms of the Zimbabwean context, by answering the vital questions that influence the successful implementation and adoption of m-learning within the diverse contexts of developing countries. This study sought to answer the research questions shown in Table 7.1.

Table 7. 1 Research questions and research objectives

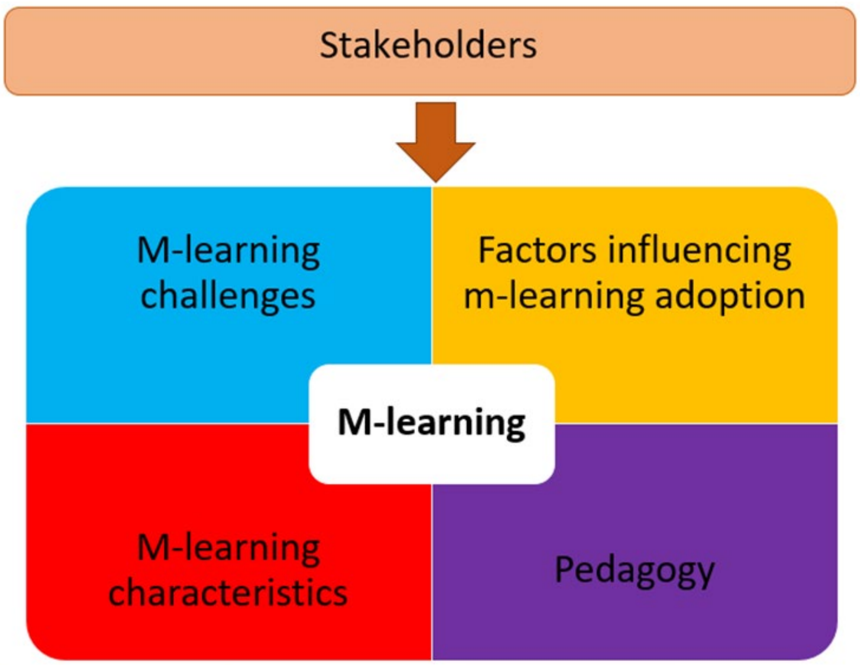
Research Questions	Research Objectives
What are the factors that influence the implementation of mobile learning in Zimbabwe?	To identify the factors that influence the implementation of mobile learning in Zimbabwe.
What are the stakeholders' personal perspectives and perceptions of the mobile learning model?	To assess stakeholders' perspectives and perceptions of the mobile learning model.
What are students' readiness and acceptance of mobile learning in Zimbabwe?	To investigate student readiness and acceptance of mobile learning in Zimbabwe.
What are the recommendations for mobile learning in tertiary institution in Zimbabwe?	To offer recommendations for mobile learning in tertiary institution in Zimbabwe.

This chapter begins by presenting a summary of the research then provides an overview of the research findings, discusses the research contributions of this study as well as its limitations, and concludes with suggestions for future research.

7.2 Summary of research

This study has shown that some key stakeholders in Zimbabwe are ready to embrace m-learning. However, not all stakeholders in Zimbabwe accept m-learning to the same extent. Some stakeholders have had exposure to m-learning, so their awareness of the benefits of m-learning encourages them to embrace m-learning. Some stakeholders are taking a cautious approach and are not sure how feasible and effective this mode of learning will be. Stakeholders with no exposure to m-learning seem more reluctant to embrace m-learning. The study has identified some key factors that influence m-learning adoption in Zimbabwe. Interestingly, the availability of cheaper mobile phones is not a factor that would motivate stakeholders to adopt m-learning in Zimbabwe. Stakeholders' attitudes towards m-learning are largely based on their perceptions of the challenges and benefits of m-learning implementation. Most studies on m-learning implementation and adoption identify m-learning challenges, m-learning benefits and m-learning features. This study does the same and goes beyond by providing insights into m-learning issues and identifying measures that similar developing countries can take to prepare themselves for m-learning implementation and adoption.

This study has developed a model for m-learning for Zimbabwe universities. The initial proposed model is based on the literature review. Thereafter, this initial model was refined based on the empirical findings from the data analysis. A summary of the development of the model is presented, starting with the initial model based on the literature review (Figure 7.1), then the modifications after interviews (Figure 7.2), after focus group discussions (Figure 7. 3), and after student the survey (Figure 7.4); the final model for m-learning in Zimbabwe universities is presented in Figure 7. 5.



M-learning challenges	**Factors influencing m-learning adoption**	**Pedagogy**	**M-learning Characteristics**
ʘ Infrastructure ʘ Cost of infrastructure ʘ Policies	ʘ **Cheaper mobile phones** ʘ Culture ʘ Usability ʘ **HCI**	ʘ What constitutes learning? ʘ Learning theories ʘ Stakeholders' expectations	ʘ Connectivity ʘ Ubiquity ʘ Mobility ʘ Training & support ʘ Collaboration ʘ Blending

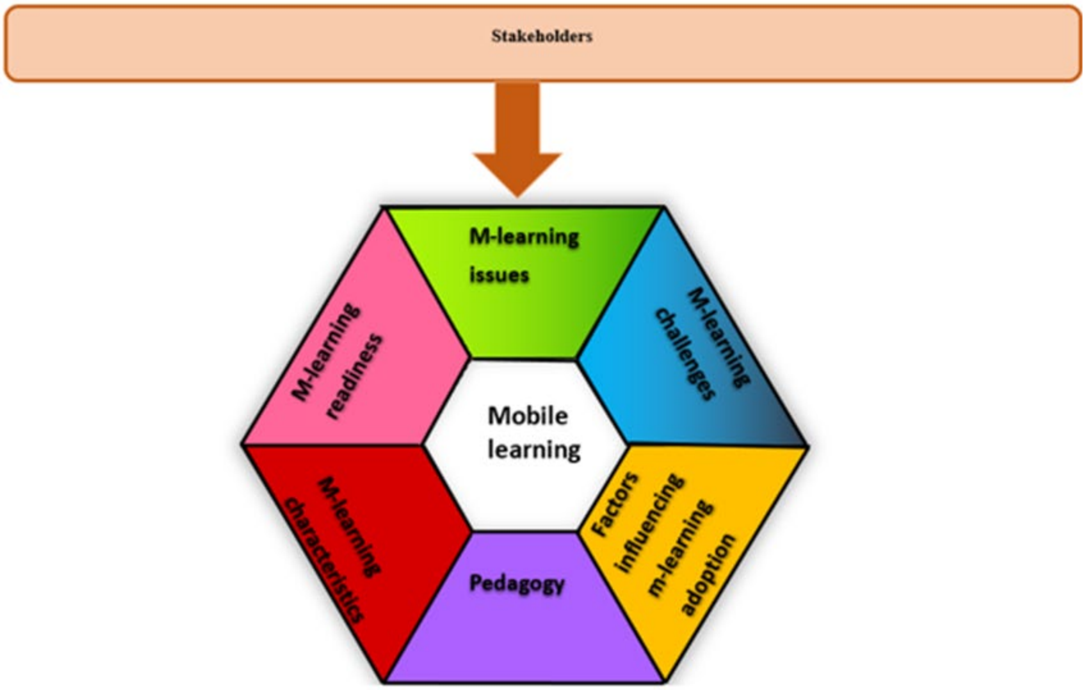
Figure 7. 1 Initial model based on literature review (section 2.15)

M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning characteristics
✱ *Distraction to academic work* ✱ *Device issues* ✱ *Poor learning habits* ✱ *Privacy*	ʘ Infrastructure ʘ Cost of infrastructure ʘ Policies ✱ *Unsuitable mobile devices* ✱ *Digital divide*	ʘ Cheaper mobile phones ʘ Culture ʘ Usability ʘ HCI ✱ *Affordability of mobile devices Mobile devices more accessible than laptops or PCs* ✱ *Advance STEM* ✱ *Institutional support* ✱ *Acceptability of m-learning*	ʘ What constitutes learning? ʘ Learning theories ʘ Stakeholders' expectations ✱ *Dynamic learning* ✱ *Self-learning*	ʘ Connectivity ʘ Ubiquity ʘ Mobility ʘ Training & support ʘ Collaboration ʘ Blending ✱ *Increased access* ✱ *Convenience* ✱ *Flexibility* ✱ *Self-learning* ✱ *Personalised learning*

Figure 7. 2 Initial model refined after interviews (section 4.8)

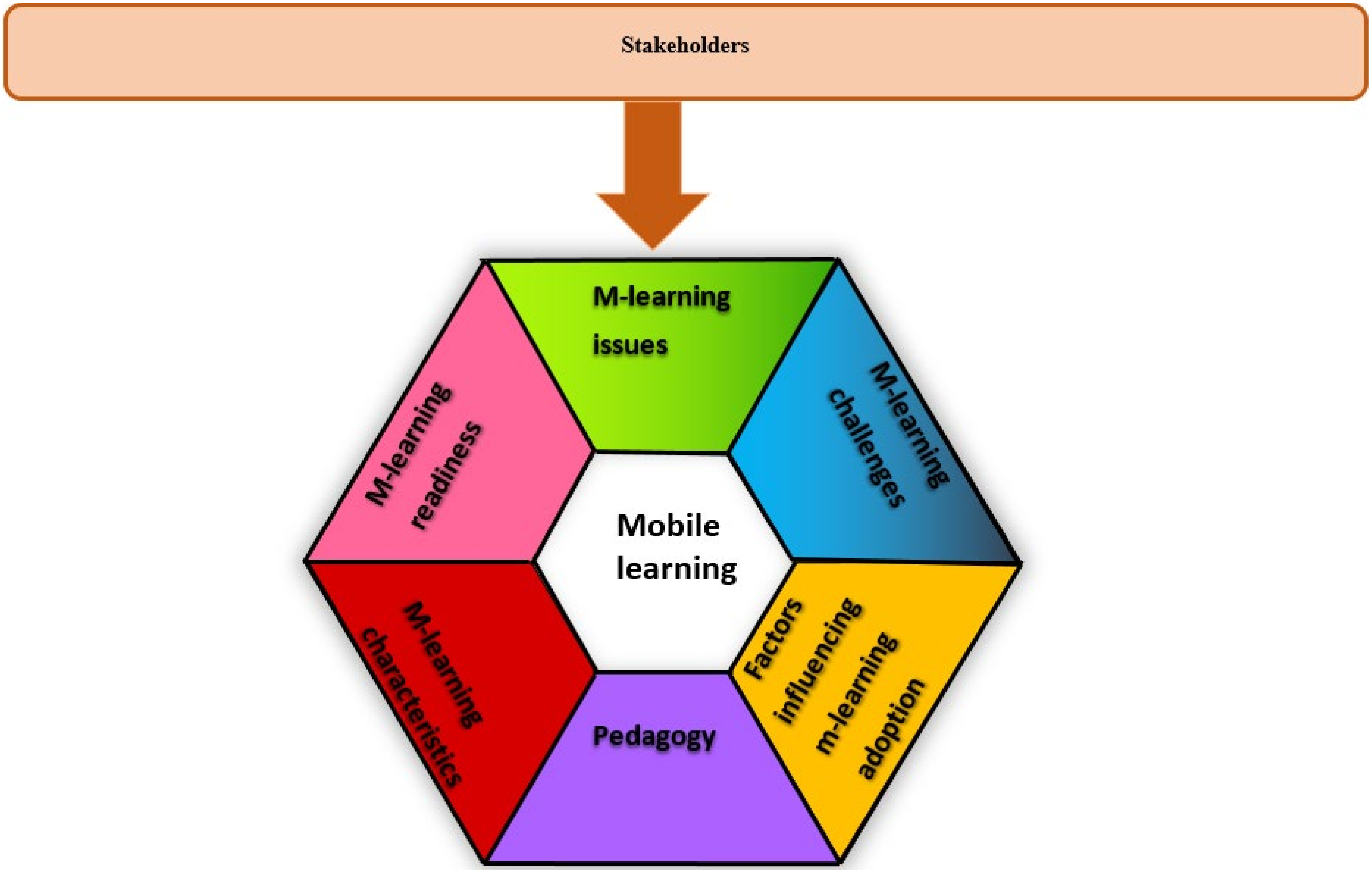
M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning Characteristics
❋ Distraction to academic work ❋ Device issues ❋ Privacy ❖ ***Poorly regarded***	ʘ Infrastructure ʘ Cost of infrastructure ʘ Policies ❋ Unsuitable mobile devices ❖ ***Affordability*** ❖ ***Instructors not ready*** ❖ ***Inequality and lacks inclusivity***	ʘ Cheaper mobile phones ʘ Culture ʘ Usability ʘ HCI ❋ Affordability of mobile devices Mobile devices more accessible than laptops or PCs ❋ Advance STEM ❋ Institutional support ❋ Acceptability of m-learning ❖ ***Mobile device accessibility and suitability***	ʘ What constitutes learning? ʘ Learning theories ʘ Stakeholders' expectations ❋ Dynamic learning ❋ Self-learning ❖ ***Poor learning habits*** ❖ ***Huge transition from traditional face-to-face mode*** ❖ ***Reduced quality of learning*** ❖ ***Leads to procrastination***	ʘ Connectivity ʘ Ubiquity ʘ Mobility ʘ Training & support ʘ Collaboration ʘ Blending ❋ Increased access ❋ Convenience ❋ Flexibility ❋ Self-learning ❋ Personalised learning ❖ ***Increased engagement*** ❖ ***Self-learning***

Figure 7. 3 Refined model after focus group discussions (section 5.6)



M-learning readiness	M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning Characteristics
❖ ***Training**** *moved from m-learning characteristics)* ❖ ***Institutional support**** *moved from factors influencing m-learning adoption)* ❖***Acceptability of m-learning****(*moved from factors influencing m-learning adoption)* ❖ ***Lack of acceptability of m-learning*** ❖***Self-learning*** *(moved from m-learning characteristics)* ❖***Not ready for independent learning***	❋ Distraction to academic work ❋ Device issues ❋ Privacy ❖ poorly regarded	ʘ Infrastructure ʘ Cost of infrastructure ʘ Policies ❋ Unsuitable mobile devices ❖ Affordability ❖ Instructors not ready ❖ Inequality and lacks inclusivity	ʘ Cheaper mobile phones ʘ Culture ʘ Usability ʘ HCI ❋ Affordability of mobile devices Mobile devices more accessible than laptops or PCs ❋ Advance STEM ❋ Institutional support ❋ Acceptability of m-learning ❖ Mobile device accessibility and suitability ❖ ***Social pressure***	ʘ What constitutes learning? ʘ Learning theories ʘ Stakeholders' expectations ❋ Dynamic learning ❋ Self-learning ❖ Poor learning habits ❖ Huge transition from traditional face-to-face mode ❖ Reduced quality of learning ❖ Leads to procrastination	ʘ Connectivity ʘ Ubiquity ʘ Mobility ʘ Training & support ʘ Collaboration ʘ Blending ❋ Increased access ❋ Convenience ❋ Flexibility ❋ Self-learning ❋ Personalised learning ❖ *Increased engagement* ❖ Self-learning

Figure 7. 4 Refined model post-survey (Section 6.10 Refined model)


Stakeholders
M-learning issues
M-learning challenges
Factors influencing m-learning adoption
Pedagogy
M-learning characteristics
M-learning readiness
Mobile learning

M-learning readiness	M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning characteristics
Training for relevant stakeholders	M-learning poorly regarded.	Infrastructure	Accessibility of appropriate mobile devices	Learning theories	Connectivity
Institutional support	Distraction from academic work Device issues	Lack of appropriate policy	Culture	Dynamic learning	Ubiquity
Create awareness of m-learning for different stakeholders	Privacy issues	Unsuitable mobile devices	Usability	Self-learning	Training
Appropriate policy to support m-learning		Affordability of mobile devices	Requisite infrastructure	Poor learning habits	Technical support
Develop independent learning skills for students		Cost of internet connection	Acceptability of m-learning	Huge transition from traditional approach	Collaboration
		Instructors not ready for m-learning	Institutional support	Reduced quality of learning	Blending
		Equity issues as some students cannot afford a suitable device		Leads to procrastination	Increased access
					Convenience
					Flexibility
					Self-learning
					Personalised learning
					Increased engagement

Figure 7. 5 A model for m-learning in Zimbabwe universities

7.3 Research findings overview

The main empirical findings are chapter-specific and were summarised within the respective chapters: chapter 4, chapter 5 and chapter 6. This section will synthesise the empirical findings to answer the study's research questions.

7.3.1 RQ1: What are the factors that influence the implementation of m-learning in Zimbabwe?

This research aimed to identify factors that influence the implementation of m-learning in Zimbabwe based on the qualitative and quantitative analysis of data from the various stakeholders. The study identified six factors that influence m-learning implementation. These factors are shown in the m-learning model for Zimbabwe universities under the golden yellow column (Table 7. 2). Table 7. 2 shows which column(s) of the model answer the RQ1 with ✓ showing column(s) that apply and an X indicating that column does not apply.

Table 7. 2 An indication where RQ1 is answered in a m-learning model for Zimbabwe universities

M-learning readiness	M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning Characteristics
X	X	X	✓	X	X

The factors that influence m-learning adoption in Zimbabwe are discussed in more detail below.

7.3.1.1 Accessibility of appropriate mobile devices

This study has identified that, with the exception of faculty heads, most stakeholders (library staff, lecturers, students and IT support staff) feel that suitable mobile phones for m-learning are not within reach for most learners. Literature (El-Hussein 2010; Iqbal and Qureshi 2012; Oyelere and Suhonen 2016) shows that the availability of cheaper mobile phones has been reported to be a factor influencing m-learning implementation (section 2.8.1.2). Yet, in this study, most stakeholders in Zimbabwe feel that the availability of cheaper mobile phones does not motivate m-learning adoption. The various stakeholders feel that the cheaper mobile phones accessible to the majority of learners are not suitable for successful m-learning implementation (sections 4.3.6.4, 4.6.3.2 and 5.3.6.2).

This study has instead identified the accessibility of appropriate mobile devices as a factor influencing m-learning adoption. The study has shown that faculty heads feel that most students have suitable mobile devices for m-learning. On the other hand, the study has also shown that the other stakeholders in this study believe that a majority of the students may have mobile devices but that most students do not have appropriate mobile devices for m-learning. Library staff, lecturers, IT support staff and learners have discussed the need for appropriate mobile devices. In this study stakeholders indicated that some of the students' mobile devices are not appropriate for m-learning because:

- Devices are not compatible with the online resources.
- Devices are defective.
- Devices are not relevant (poor functionality, poor processing power of mobile device, limited functionality, unsuitable mobile devices that need constantly plugged to a power source).

The study showed that some students cannot afford appropriate mobile devices thus affordability and accessibility of suitable devices are not the same for all learners. Learners are eager to embrace m-learning if appropriate mobile devices are affordable. It is likely that faculty heads do not have a clear picture when it comes to the kind of mobile devices the majority of students own. There is sufficient evidence from the study that most students own a mobile device, but the computational power or functionality of the devices are clearly not uniform. Given that lecturers, library staff, IT support staff would interact with learners more so than faculty heads, it is likely that faculty heads have not had ample opportunity to clearly evaluate the accessibility of appropriate mobile devices amongst the learners.

7.3.1.2 Culture

Institutional culture can be an obstacle to m-learning (Torres, Evans and Schneider 2019). Faculty heads and lecturers appreciate that mobile devices are teaching and learning aids (section 4.4.4). There are indications from lecturers that some students already use mobile devices to access learning content (section 4.5.9.1). Universities in Zimbabwe seem receptive to m-learning. However, not all students perceive mobile devices as teaching and learning tools (section 5.3.6.2). There is a need to understand cultural boundaries and social environments particularly in developing countries when implementing m-learning (Keengwe and Bhargava 2014). Most students in Zimbabwe use their mobile device to access social media, with fewer students using mobile devices for educational purposes (section 6.3). Given the acceptance of the traditional approach to teaching and learning, some students feel that using mobile devices for academic work would not be an effective way of studying. While other students feel mobile devices are more suited to learning skills like cooking or how to fix things. The idea of mobile devices as educational tools is not yet sold to all the students (section 5.3.6.2). The effect of culture and country m-learning implementation particularly in developing countries has been explored in (section 2.9.4). Most learners would have been accustomed to using mobile devices as communication and entertainment tools not as educational aids. Hence, it is unsurprising that some learners will not readily perceive mobile devices as learning aids.

It may take a while for some students to perceive mobile technologies as educational tools. This could also be attributed to learners perceiving learning being limited to content delivery, thus overlooking other aspects of learning such as collaboration, increased access to resources, and self-learning which can occur through the utilisation of mobile technologies. Given that most m-learning at this point in Zimbabwe will be mostly informal, and will depend on levels of exposure, it is unsurprising that some students do not perceive mobile devices as learning aids. Some learners reside in remote locations thus may not have had any exposure in utilising mobile technologies for teaching and learning, and are likely to experience this only at tertiary institutions. There is need for a mindset shift for learners who only perceive mobile devices as communication and entertainment tools. This could be achieved by making students aware of ways to utilise mobile technologies to improve their learning.

7.3.1.3 Usability

Only IT support staff and students considered usability as a factor influencing m-learning adoption (section 4.6.3.1). Students in Zimbabwe find mobile technologies easy to use. Most of the learners have used mobile devices for a long time and do not require technical support in order to use mobile technologies. Some students are more competent than others, particularly those in ICT courses (section 5.3.5.6). These students have a greater appreciation of the power of mobile technologies and how these can be utilised beyond content delivery with knowledge of what resources they can use to extend their learning. Possibly more discussion on the usability of mobile technologies in teaching and learning could help students and other stakeholders to have a greater appreciation on the utilisation of these devices as learning aids. The inherent problems of mobile devices such the size of device, screen and keypad discussed in the literature (section 2.11.2) do not seem to present usability challenges for Zimbabwean students. The current digital citizens who are likely to use mobile devices on a daily basis are accustomed to the small devices with the small screens and perhaps no longer focus on these aspects.

7.3.1.4 Requisite infrastructure

This study has confirmed that in developing countries like Zimbabwe, successful m-learning implementation and adoption hinges on the availability of requisite infrastructure. This study has found that infrastructural challenges in Zimbabwe are in the form of poor Internet connectivity, intermittent power supplies, congested networks and limited locations with Internet access as discussed by all stakeholders including library staff (section 4.3.6.1), faculty heads (section 4.4.7.1), lecturers (section 4.5.10.1), IT support staff (section 4.6.3.2) and students (section 5.3.6.1 and (section 6.7.2.1). Previous studies have shown that inadequate infrastructure is a major obstacle to m-learning implementation, especially in developing countries (section 2.9.1). The study showed that poor connectivity was not only a result of poor infrastructure: students linked connectivity issues to cost, citing that the cost of data bundles was an obstacle to Internet access. In Zimbabwe, there is no uniform level of infrastructure at different tertiary institutions. There is evidence of some degree of infrastructure. It may be necessary to see how the available infrastructure can best be used in m-learning implementation. Part of the solution could be through bandwidth management. An alternative and more ideal situation would see more adequate infrastructure in place resulting in reliable Internet connectivity which would enable effective m-learning.

7.3.1.5 Institutional support

This study showed that, similar to previous studies, institutional support is a factor that influences m-learning implementation (section 2.6.6). Faculty heads feel institutional support in the form of management buy-in, promotion of m-learning and provision of resources would influence m-learning adoption (sections 4.4.6.3 and 4.4.7.3). The study also indicated that students feel there is lack of institutional support in their universities, and that institutions are not supportive of using mobile devices for teaching and learning. Some students feel the lack of institutional support is exhibited by the lack of technical support for students when using mobile devices (section 6.7.2.3). Institutional support plays a big role in the implementation of m-learning since m-learning requires resources. Tertiary institutions have the capacity to get buy-in from other stakeholders which would likely encourage m-learning adoption as it is visible to learners that the institution not only approves of but also supports this mode of learning.

7.3.1.6 Acceptability of m-learning

The study has shown that acceptability of m-learning is heterogeneous within and across the different stakeholders. Acceptability of m-learning is a crucial factor for m-learning adoption and implementation. Most studies have researched the acceptability of m-learning from the perspective of learners only (Al-Hunaiyyan, Alhajri and Al-Sharhan 2016; Gedik et al. 2012; Liu, Li and Carlsson 2010). Acceptability of m-learning has been evaluated for the different stakeholders in this study.

7.3.1.7.1 Library staff

Library staff are keen on m-learning however, there are concerns about the use of mobile technologies and how this would impact learning (section 4.3.7). Library staff raised issues on increased plagiarism and issues associated with use of mobile technologies such as distraction from academic work and how mobile technologies are prone to theft and virus attacks (section 4.3.8).

7.3.1.7.2 Faculty heads

The study has found that faculty heads are keen to embrace m-learning (section 4.4.6.1). Faculty heads' are aware that successful implementation of m-learning will depend on a variety of aspects such as funding, infrastructure (section 4.4.7.1), technical support (section 4.4.6.2), supporting policies (section 4.4.6.3), and management support (section 4.4.7.3). The faculty heads recommend a well thought process that can enable monitoring and evaluation (section 4.4.6.3).

7.3.1.7.3 Lecturers

The study has shown that acceptability of the m-learning mode is not uniform amongst lecturers (section 4.5.8.2). Some lecturers are not keen to take up m-learning because of a lack of resources with others indicating m-learning may not be most effective for their teaching areas. There are indications that some lecturers will just not accept this mode of learning at the moment. Lecturers are eager to embrace m-learning, based on the following benefits for learners:

- Increased access to learning material.
- Increased engagement of learners.
- Students would enjoy this mode of learning.
- Affords learners an opportunity for self-directed learning.

Some lecturers are willing to embrace m-learning if the following conditions are met:

- Adequate technical support.
- Necessary hardware.
- Reliable connectivity.
- Training.

7.3.1.7.4 IT support staff

Because of the perceived benefits of m-learning, the IT support staff are keen to embrace this technology (section 4.6.3.3. IT support staff believe that the flexibility offered by m-learning enables learners to study at their own pace, which is a positive outcome. IT support staff are keen to embrace m-learning because m-learning increases access to educational resources while reducing the demand on lecture theatres thus killing two birds with one stone. IT support staff acknowledge the need for appropriate infrastructure for successful m-learning implementation and adoption. Despite the keenness of IT support staff, they concede that mobile technologies could distract some learners from their academic activities (section 4.6.3.2).

7.3.1.7.5 Students

There is no consensus among students regarding the acceptability of the m-learning mode in Zimbabwe (section 5.3.7.3). Some students feel that they are not ready to move from the traditional approach to the m-learning mode, preferring face-to-face interactions with the instructor. Some learners are concerned that the use of mobile technologies may constantly distract them from academic work. Some learners see the use of mobile technologies in learning as ineffective, with others claim that they cannot focus on academic work when using mobile devices. However, some learners already use mobile technologies informally to extend their learning and want to see this done more formally. Other students embracing m-learning feel they already use their mobile devices frequently and would like to use these devices for their learning journey as well. Other students are interested in m-learning because it gives access to a wide range of sources that can supply relevant information.

The factors influencing m-learning adoption in Zimbabwe are summarised in Figure 7. 6.

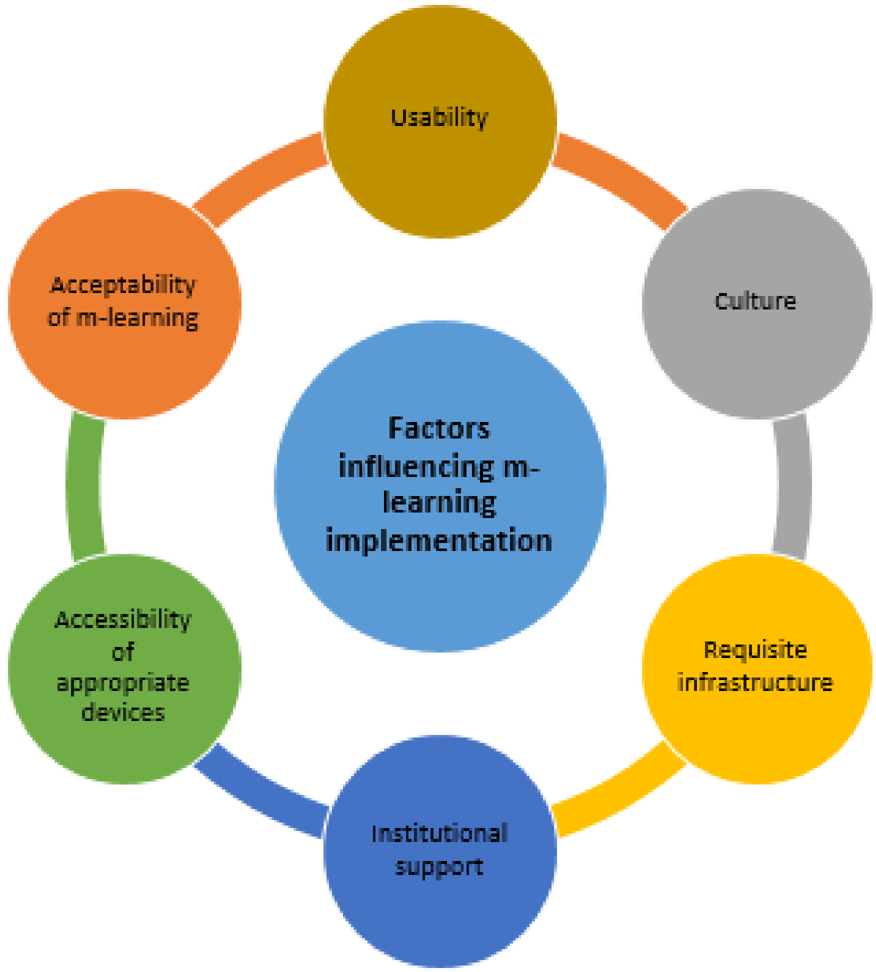


Figure 7. 6 Summary of factors influencing m-learning adoption

7.3.2 RQ2: What are stakeholders' personal perspectives and perceptions of the m-learning model?

This study sought to assess the stakeholders' personal perspectives and perceptions towards the m-learning model. Based on the interviews, focus group discussions and the survey the data analysis demonstrates that there is some eagerness to adopt m-learning and that opinions and perspectives towards m-learning are largely based on the challenges and benefits of m-learning. The challenges of m-learning in the final model are indicated in the blue columns, while m-learning issues are in the green column in an m-learning model for Zimbabwe universities (Table 7.3), with the benefits of m-learning shown in the red column. The perceptions and perspectives are evaluated according to the different stakeholders, namely library staff, faculty heads, lecturers, IT support staff and students (respectively).

Table 7. 3 An indication where RQ2 is answered in a m-learning model for Zimbabwe universities

M-learning readiness	M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning Characteristics
X	✓	✓	X	X	✓

7.3.2.1 Library staff

These staff understand faculty needs and can help with the information strategies of tertiary institutions in the digital age.

7.3.2.1.1 Eagerness for m-learning

This study has shown that library staff are keen to see learners utilise their mobile devices to access library resources. Library staff feel that libraries have adequate online resources that could enable m-learning (section 4.3.5.1); however, they acknowledge that these resources may not always be accessible to learners (section 4.3.5.2). The online resources provided by the library are inaccessible because: (1) some mobile devices are not compatible with the online platforms used by the libraries; and (2) poor Internet connectivity makes it a challenge to access resources.

7.3.2.1.2 Challenges to m-learning adoption

Poor Internet connectivity is a barrier to m-learning according to the library staff (section 4.3.6.1). They attributed this to inadequate equipment and low bandwidth preventing access to online resources. There is a lack of technical know-how about the use of mobile devices for learning, according to library staff (section 4.3.6.3). Without the necessary skills, learners may shy away from using mobile devices to extend their learning. The lack of know-how may dissuade learners from integrating mobile technologies with learning.

Library staff feel that m-learning can lead to concerns about the actual learning process (section 4.3.8.3). These concerns include increased plagiarism, as students recycle ideas and information. Moreover, learners can easily be distracted from academic work when using mobile technologies and instead spend more time on social media platforms or accessing inappropriate material.

Library staff feel that appropriate mobile devices are not affordable for all students; thus, m-learning can widen the digital divide between learners with appropriate devices and those without (section 4.3.8.4). Library staff feel that mobile devices, due to their widespread availability and usage, are prone to theft, virus attacks, can easily be lost, and constantly need to be recharged (section 4.3.8.2).

7.3.2.1.3 Benefits of m-learning

The library staff expect that m-learning will lead to faster communication (section 4.3.7.2). Library staff believe m-learning will result in quicker dissemination of information, quicker clarification when needed or instant answers, quicker acknowledgement of academic instruction by learners and faster communication between learners and instructors and amongst learners. Library staff anticipate that m-learning will lead to increased access to resources, which will translate to better academic outcomes (section 4.3.7.3). M-learning is seen as a mode that supports collaboration as students exchange and share knowledge on a larger scale (section 4.3.7.4).

7.3.2.2 Faculty heads

These are responsible for the academic leadership and management of schools and departments in the university.

7.3.2.2.1 Eagerness for m-learning

The faculty heads are keen to embrace m-learning, with mobile technologies expected to have a greater impact than other ICT tools in African universities. Faculty heads believe that most students have suitable devices for learning purposes; however, other stakeholders believe that most students do not have appropriate mobile devices for m-learning (section 4.4.5.1). Faculty heads anticipate m-learning will be widely accepted by students, however there is evidence that some academics and some learners are not ready to embrace m-learning yet (section 4.5.10.2 and section 5.3.7.3). There are some reservations about moving from the traditional-approach to the m-learning mode. Faculty heads believe that supporting policy, promotion of mobile technologies and management buy-in would assist with successful m-learning implementation. Faculty heads are keen on m-learning but take a cautionary approach, citing the need for the monitoring and evaluation of m-learning activities (section 4.4.6.3).

7.3.2.2.2 M-learning challenges

The inadequacy of resources was one issue acknowledged by faculty heads (section 4.4.7.1). The successful implementation of m-learning requires an adequate infrastructure and technical support. Moreover, faculty heads are concerned that some learners may not have the discipline to use mobile devices for learning. Another concern was that only a few of the students are independent learners; most require constant guidance (section 4.4.7.2).

7.3.2.2.3 M-learning benefits

Faculty heads see the flexibility of m-learning as a major benefit (section 4.4.5.2) as it allows learners to catch up on missed lectures, or access learning material at a convenient time with no time or location boundaries. Faculty heads, however, recognize that this flexibility should meet industry and learning institution standards. Increased access to current information as well as increased interaction between learners and lecturers are some benefits of m-learning perceived by faculty heads (section 4.4.5.3). Mobile technologies will offer convenience (section 4.4.5.6) as it will allow faster dissemination of information and resources, they remove the constraints of time and place, and the student can learn at his/her own pace.

7.3.2.3 Lecturers

For the lecturers who guide the educational experience of learners, m-learning offers new ways of teaching.

7.3.2.3.1 Eagerness for m-learning

M-learning is expected to positively impact teaching and learning by most of the lecturers with a few having reservations about this mode of teaching and learning (section 4.5.10.3). Lecturers believe that m-learning would shift teaching and learning from being teacher-centred to learner-centred. It is perceived that if instructors have full knowledge of the potentials of mobile technologies in teaching and learning, this could eliminate the divided attitudes towards the suitability of m-learning as a teaching and learning mode, and any other misconceptions about m-learning. Some lecturers already use m-learning with their students informally to support learning activities (section 4.5.9.1) including content delivery, announcements, discussion groups, sharing video/audio clips. To actively engage learners, some lecturers have quizzes or chats with students, brainstorm activities for group tasks or have discussions with learners (section 4.5.10.2).

Some lecturers feel that m-learning is not suitable for the current cohort of students who are not self-directed, but is better suited to those who are self-starters. Some lecturers feel there is need for policy to incorporate the use of mobile technologies in teaching and learning (section 4.5.8.5), as policy will guide the use of mobile devices in education, thus leading to sustainable deployment and utilisation of m-learning.

7.3.2.3.2 M-learning challenges

The challenges of poor infrastructure discussed by other stakeholders are also echoed by lecturers (section 4.5.10.1). The study shows that lecturers feel that intermittent power supplies and poor Internet connectivity hamper m-learning. In some institutions, the infrastructure seems to be adequate for m-learning but is hampered by power cuts. Access to suitable mobile devices for students is a big concern for lecturers, as most students cannot afford appropriate devices (section 4.5.10.2). Lecturers believe that most students do not have suitable devices for m-learning. Lecturers would prefer mobile devices to be supplied by institutions rather than follow the BYOD policy to avoid equity issues as students have different financial capacities. Lecturers feel successful m-learning requires adequate technical support. Lecturers feel they are ill-equipped as they lack knowledge to produce content for mobile devices, how to integrate mobile technologies for teaching and learning to bring the most benefit for learners (section 4.5.10.4).

7.3.2.3.3 M-learning benefits

This study showed that lecturers see m-learning as a tool that can enhance student collaboration (section 4.5.7.1) and increase communication between instructors and learners (section 4.5.7.6). However, some believe that one disadvantage is that students will contact instructors at inappropriate times. They also feel that the flexibility of m-learning allows instructors and learners to access content anywhere anytime, which means learning is not restricted to specific locations or times very beneficial (section 4.5.7.3). M-learning enables learners to rewind or fast-forward, which lecturers perceive as convenient (section 4.5.7.5). M-learning could free up some time for lecturers as they will not have to be in a physical location at specific times to deliver lectures. Lecturers believe that most learners have access to mobile devices and that learners would be more engaged with their learning when using mobile devices. Lecturers believe that learners would enjoy using mobile technologies for learning, and that m-learning promotes autonomous and self-directed learning (section 4.5.10.5).

7.3.2.4 IT Support staff

These personnel provide IT support to learners and lecturers.

7.3.2.4.1 Eagerness for m-learning

IT support staff seem keen on m-learning (section 4.6.3.3), but are very mindful of the infrastructure required the success of m-learning implementation.

7.3.2.4.2 M-learning challenges

IT support staff believe that a major obstacle to successful m-learning implementation is a lack of resources, which has to do with the infrastructure (section 4.6.3.2). IT support staff identified poor connectivity, insufficient bandwidth and a lack of resources as impediments to successful m-learning implementation. IT support staff feel tertiary institutions should have more locations with Internet access. Other resources required for successful m-learning implementation according to the IT support staff is the actual hardware in the institutions. IT support staff believe some of the mobile devices owned by students are not compatible with the institution servers (section 4.6.3.2). IT support staff feel that the current support teams are not large enough to provide support efficiently (section 4.6.3.2).

IT support staff feel that training is required to make lecturers aware of the benefits of m-learning. However, some IT support staff are concerned that mobile technologies may distract learners from academic work (section 4.6.3.2).

7.3.2.4.3 M-learning benefits

IT support staff believe that learners would benefit from the flexibility offered by m-learning (section 4.6.3.3). Learners can study at their own pace, and have increased access to educational resources. IT support feel that m-learning would reduce the demand on lecture theatres. Instructors would also benefit from pre-packaging learning material, thus freeing up some time.

7.3.2.5 Students

Students are the consumers of m-learning.

7.3.2.5.1 Eagerness for m-learning

The level of student eagerness to adopt m-learning in Zimbabwe could be categorised according to three groups: (1) those not keen about m-learning, (2) those taking a cautious approach, and (3) those who are eager to adopt m-learning (section 5.3.7.3). Students who are not keen about m-learning feel they are not yet ready to utilise mobile technologies in their learning, and prefer to have an instructor as their main source of knowledge. These students also feel that mobile technologies are for the learning of skills such as cooking, not for the transmission of educational content. The learners taking a cautious approach are eager but rather hesitant because they are not sure how this mode will affect their level of understanding of concepts. Some learners would prefer an approach that gradually incorporates mobile technologies in teaching along with traditional learning methods. Some learners are concerned that mobile technologies will distract them from their academic work. Some learners are uncomfortable about adopting m-learning as they believe the credibility of studies done using this mode are questionable. The learners keen to adopt m-learning have already had some exposure to m-learning. These learners are enthusiastic about m-learning as they believe this could be a solution to situations where a student has a job and has difficulty taking time off from work to pursue studies. Some learners are eager because they feel m-learning will make them engage more with their academic work.

7.3.2.5.2 M-learning challenges

Like the rest of the stakeholders learners feel there is inadequate infrastructure, which makes it challenging to access Internet (sections 5.3.6.1 and 6.7.2.1). Poor Internet access is more pronounced in remote locations where intermittent power supplies are directly linked to poor connectivity. Learners feel that m-learning is feasible when users have mobile devices with high processing power and advanced functionalities. However, many students cannot afford the necessary devices. Data bundles imposed an extra cost, placing the Internet access out of reach and posing another challenge to the adoption of m-learning.

Some students believe that m-learning is a huge transition from the traditional approach they are used to and would still prefer learning that is led by an instructor in the same physical location (section 5.3.7.1). It is evident that for some learners, learning is a social activity led by the instructor. To such students there is a guarantee that they can understand more as they have access to the instructor in the same location so concepts can be explained in a different until they understand. Some students feel modes of teaching which not the traditional face-to-face are poorly regarded in Zimbabwe. Some learners believe that some instructors are not ready to embrace m-learning. Other students feel the use of mobile devices may distract them from academic work (sections 5.3.7.1 and 6.7.1.2). Some learners are concerned that the m-learning mode would reduce the quality of learning (sections 5.3.7.1 and 6.7.5.2). Areas of concern include plagiarism and cheating. Issues of equity are a concern for learners regarding m-learning. Students are aware that not all of them can afford suitable mobile devices and it is worrisome to these students how inclusive m-learning can be established in environments like Zimbabwe where there is inequitable accessibility to appropriate mobile devices (sections 5.3.6.3 and 6.7.2.2).

7.3.2.5.3 M-learning benefits

Learners in Zimbabwe believe a benefit of m-learning is its convenience (sections 5.3.5.1 and 6.7.3.4). Students feel it makes it easier to access content, saves on transport costs as learners do not always have to go to campus, and mobile devices are lighter than textbooks. Most students are believe that m-learning is more engaging than the traditional approach (sections 5.3.5.2 and 6.7.5.1). This is because there are alternative sources of concepts, platforms to share information with peers, and alternative options for communication not limited to face-face interaction. Learners have no doubt that m-learning will lead to increased access to academic resources (sections 5.3.5.3 and 6.7.3.1). Learners can access online resources in text, audio or video format, peers or online communities and online collaborations. Being able to learn when it suits the learner was another perceived benefit of the flexible nature of m-learning (sections 5.3.5.6 and 6.7.3.4). Learners feel they can control their learning and decide when they do their learning. This is very beneficial for students with jobs whose work hours clash with class times. Learners believe m-learning will lead to increased communication with their instructors and their peers (sections 5.3.5.3 and 6.7.3.1). A summary of the various stakeholders' perceptions of m-learning is presented in Figure 7. 7.

Library staff

- **Eagerness**
- *Keen and acknowledge library resources may not be accessible.*
- **Challenges**
- *Inadequate infrastructure*
- *Problems with actual learning e.g plagiarsim*
- *Mobile devices not affordable to all.*
- **Benefits**
- *Faster communication*
- *Increased access to resources*
- *Collaboration*

Faculty heads

- **Eagerness**
- *Keen, and are convinced m-learning will be widely embraced.*
- **Challenges**
- *Inadequate infrastructure.*
- *Mobile devices not affordable to all.*
- *Lack of technical support*
- **Benefits**
- *Flexibility*
- *Increased access to resources*
- *Faster dissemination of information*
- *Learning occurs at pace of learner*

Lecturers

- **Eagerness**
- *Most are keen with suggestions of the need for professional development and need for appropriate policy.*
- **Challenges**
- *Inadequate infrastructure*
- *Mobile devices not affordable to all.*
- *Lack of technical support.*
- **Benefits**
- *Collaboration*
- *Flexibility*
- *Conveneint*
- *Free-up time for instructors*
- *Learners would be more engaged.*
- *Opens up opportunities for self-directed learning.*
- *Increased access*

IT Support staff

- **Eagerness**
- *Seem keen, with a cautious approach with the knowledge of what is required for successful m-learning implementation.*
- **Challenges**
- *Inadequate infrastructure, evidenced by poor connectivity, insufficient bandwidth and outdated hardware.*
- *Mobile devices not affordable to all.*
- **Benefits**
- *Flexibilty*
- *Increased access*
- *Frees up time for instructors*

Students

- **Eagerness**
- *Some are not keen for m-learning, some are taking a cautious approach to m-learning and others are enthusiatic about m-learning. Some learners feel they need training. Learners prefer a blended approach.*
- **Challenges**
- *Inadequate infrastructure*
- *Mobile devices not affordable to all.*
- *Huge transtions from traditional approach*
- *M-learning may be poorly regarded.*
- *Distraction from academic work.*
- *Reduce quality of learning.*
- **Benefits**
- *Convenience*
- *More engaging*
- *Increased access*
- *Flexibility*
- *Enhance communication.*
- *Collaboration*

Figure 7. 7 Summary of stakeholders’ perceptions towards m-learning

On the whole, most of the stakeholders are keen to embrace m-learning with some taking a more cautionary approach. Some learners feel they could benefit from training on m-learning. Students not so keen on m-learning seem to have little awareness of m-learning and as a result have reservations about how this will affect their learning. This study has shown that inadequate infrastructure is a challenge to m-learning and this is mentioned by all stakeholders. Although some learners have appropriate mobile devices, this study has shown that equity issues are a concern for all stakeholders. Stakeholders are concerned about students who cannot afford appropriate mobile devices and how this will affect their learning if the m-learning mode is adopted. If accessibility of suitable mobile technologies is not uniform, then m-learning would create a digital divide and simultaneously fail to democratise education. All stakeholders are convinced that m-learning would increase access to learning resources. This study has shown that flexibility is a benefit of m-learning that most stakeholders value.

7.3.3 RQ3: What is students' readiness and acceptance of mobile learning in Zimbabwe?

The analyses of the data from the focus group discussions and the student survey, have shown that most students are ready and willing to embrace m-learning; however, others are not ready to embrace m-learning at the moment. This is addressed in ***A model for m-learning in Zimbabwe universities*** in the purple column (pedagogy) and the pink column (M-learning readiness) in Table 7. 4 A model for m-learning in Zimbabwe universities.

Table 7. 4 An indication where RQ3 is answered in a m-learning model for Zimbabwe universities

M-learning readiness	M-learning issues	M-learning challenges	Factors influencing m-learning adoption	Pedagogy	M-learning Characteristics
✓	X	X	X	✓	X

7.3.3.1 M-learning acceptance

Some learners have some experience with m-learning on varying scales. Learners who have been exposed to m-learning described their experiences as positive and are ready to adopt m-learning (sections 5.3.7.5 and 6.7.4.2). Other learners informally use m-learning to supplement lecture content and find this to be beneficial. Although power cuts affect use of m-learning some learners are finding ways to circumvent this problem using mobile devices and backing up the work on laptops or desktop computers. A few learners out rightly are not willing to embrace m-learning as they feel mobile technologies are not educational tools (sections 5.3.7.6 and 6.7.4.2). Some learners are hesitant about m-learning for three main reasons: (1) they are not sure if they will be able to grasp all concepts using the m-learning mode (2) they feel m-learning is a huge transition from the traditional approach and (3) equity issues (sections 5.3.7.3 and 6.7.5.2). The students who are fearful of m-learning because it may affect their understanding need reassurance that m-learning takes a blended approach thus supplementing what they are being taught, and does not eliminate or minimise the role of the instructor. Since m-learning requires integration not substitution, the traditional approach still remains in place with m-learning offering more opportunities to extend learning. Equity issues concern students as they are aware that some of their peers will not be able to afford appropriate devices to utilise m-learning. Generally speaking, in Zimbabwean tertiary institutions, there is a lot of cooperation so rarely do students take the approach of "every man for himself", more so now when Zimbabwe is facing socio-economic challenges. Most students have an appreciation of how the lack of a suitable device would mean that one cannot access the different resources or tap into the benefits of m-learning, recognising that those without appropriate devices will be disadvantaged.

Those learners who have had positive experiences and are raring to go, are interested in m-learning based on the characteristics of m-learning. Although m-learning has many features as discussed in section 2.8.1, students in Zimbabwe are willing to embrace this technology based on the affordances described below.

7.3.3.1.1 Convenience

This study has found that some learners in Zimbabwe universities are convinced m-learning will save them time and effort and are therefore willing to embrace m-learning. The findings are reflective of previous studies in which learners are interested in m-learning because of its convenience (Iqbal and Bhatti 2016; Lakshminarayanan, Ramalingam and Shaik 2015). Learners find the portability of mobile technologies enables them to study at any location with no time restrictions, submit assignments remotely and rewind or fast forward learning content (sections 5.3.5.1 and 6.7.3.4). Some learners, however, argue that while it may be convenient to rewind learning content and hear it several times, this does not mean that the concepts will be understood. It is imperative that students become aware that m-learning is not meant to replace the instructor, but rather opens up opportunities to supplement their learning with other sources. M-learning therefore does not eliminate access to the instructor but rather enhances the traditional approach to teaching and learning.

7.3.3.1.2 Increased engagement

The value of integrating mobile technologies in learning is supported by findings of this study. Learners are willing to accept m-learning because it offers opportunities of increased engagement (section 5.3.5.2). Traditional approaches to teaching and learning will be transformed to unconventional methods (Spangler, Rodi and Kiernan 2016). Some learners are already tapping into unconventional methods of learning such as online tutorials, using online resources to reduce dependence on the instructor as the only source of knowledge which they find more engaging. Some learners feel m-learning will make it easier for shy students to engage more online rather than face-to-face. Some learners have had experience using mobile technologies for different learning activities that involved various applications. The positive experiences of the students are a clear indication that they are willing to embrace m-learning (section 5.3.5.6).

7.3.3.1.3 Increased access

This study has found that, generally, students would accept m-learning because it increases access to educational resources (sections 5.3.5.3 and 6.7.3.1). The findings of this study echo findings from previous studies (Koole 2009; Asiimwe and Grönlund 2015; Osang, Ngole and Tsuma 2013) indicating that students believe m-learning will extend their sources of knowledge beyond instructors to include peers and online communities. Learners also feel that m-learning increases access to other resources be it text, audio or video which become just a click away; thus, the source of knowledge goes beyond what the traditional approach would offer.

7.3.3.1.4 Flexibility

This research has shown that students are keen to control their learning (sections 5.3.5.6 and 6.7.3.4) and are willing to embrace a mode of learning that offers the flexibility to learn when it is convenient for them (Huang and Yu 2019; Shuib, Azizan and Ganapathy 2018). Learners accept m-learning as it will afford them the flexibility to work and study simultaneously without the burden of having to take time off work. Taking time off work to pursue studies is a challenge for some learners. Some learners are interested in m-learning so that they can engage in learning activities at ties that best suit them.

Some have lectures that are scheduled for times that are not convenient, so the flexibility of m-learning would enable them to access learning material at a more convenient time. Some learners are willing to embrace m-learning as the mode is self-based so each learner can determine his/her own learning pace. Some learners feel the traditional approach does not allow them to move at their own pace. An example given was that sometimes instructors take an inordinately long time to introduce a concept; with m-learning, if a student understands the concept, she/he can quickly move on. It is possible that the socio-economic situation in Zimbabwe is now pressuring students to study and work simultaneously; hence, the need for flexibility in learning. This is a shift from over a decade ago when most tertiary students pursued their studies full-time. M-learning enables students to combine work with study, as is done by most students in developed countries.

7.3.3.2 Students' readiness for m-learning

This research has shown two different levels of student readiness for m-learning. In this study it was found that some learners are not yet ready for m-learning, while others are confidently ready.

7.3.3.2.1 Lack of readiness

Students who are not ready for m-learning do not perceive mobile technologies as being educational tools, but rather tools for communication and the learning of life skills such as cooking. It is understandable that, without exposure to m-learning and an appreciation of how mobile technologies can be used to enhance learning, it may be difficult to be prepared for the m-learning mode (sections 5.3.7.1, 5.3.7.4 and 6.7.3.6). In such cases, there may be a need to create awareness and demonstrate how m-learning can complement the traditional approach to teaching and learning. In developing countries like Zimbabwe, while access to mobile technology is widespread, most devices are used solely for communication, particularly for social media interactions. It can be challenging to envisage these mobile devices as anything other than a communication tool. Some learners feel that a change to the m-learning mode is a big shift from the traditional approach. These students are concerned about how this mode will affect their own learning in terms of whether they will be able to understand concepts, and how this will affect their qualifications.

Some learners feel they are not ready to use mobile devices for learning as they prefer constant intervention from their instructors. Some learners prefer the traditional approach to teaching and learning with an instructor in front of them. These students depend heavily on the one source of knowledge - their lecturers. Introducing m-learning would change their idea of learning and they feel they are not yet ready for this change which seems rather drastic to them. This change calls for measures to prepare and support learners so that they understand of how the transition will affect their learning.

Some learners feel they are not ready for m-learning based on the discipline required for this mode of learning. Such students feel they lack the discipline to (1) curb the distractions from social media and (2) successfully use this mode without too much procrastination. While the flexibility of m-learning is to be applauded for enabling learners to learn at their own pace and convenience, some learners are not sure they have the personal discipline to enjoy that flexibility without completely stopping the entire learning process.

7.3.3.2.3 Confident readiness

Some learners are confident that they are ready for m-learning, particularly those who have jobs. These learners find m-learning is a solution to their predicament of trying to work and study simultaneously, but often not being able to take time out for study commitments. Some learners are ready for m-learning as it would be more convenient for them. It is likely that students who feel confident that they are ready for m-learning have already had some exposure to it (sections 5.3.7.4, 5.3.7.5 and 6.7.4.2). These students are likely to have had positive experiences and have an appreciation of how m-learning can extend their learning. Some learners who have had some exposure to m-learning no longer depend on instructors as the only source of knowledge. These learners are gradually becoming more and more self-directed and autonomous.

The learners who are confidently ready for m-learning would like a seamless environment that enables m-learning to run smoothly. This calls for adequate infrastructure. In addition, these learners would like to see m-learning implementation undertaken in an inclusive manner that is beneficial and accessible to all learners. This would require learners to have appropriate mobile devices. A diagrammatic summary of students' acceptance of and readiness for m-learning is given in Figure 7.8.

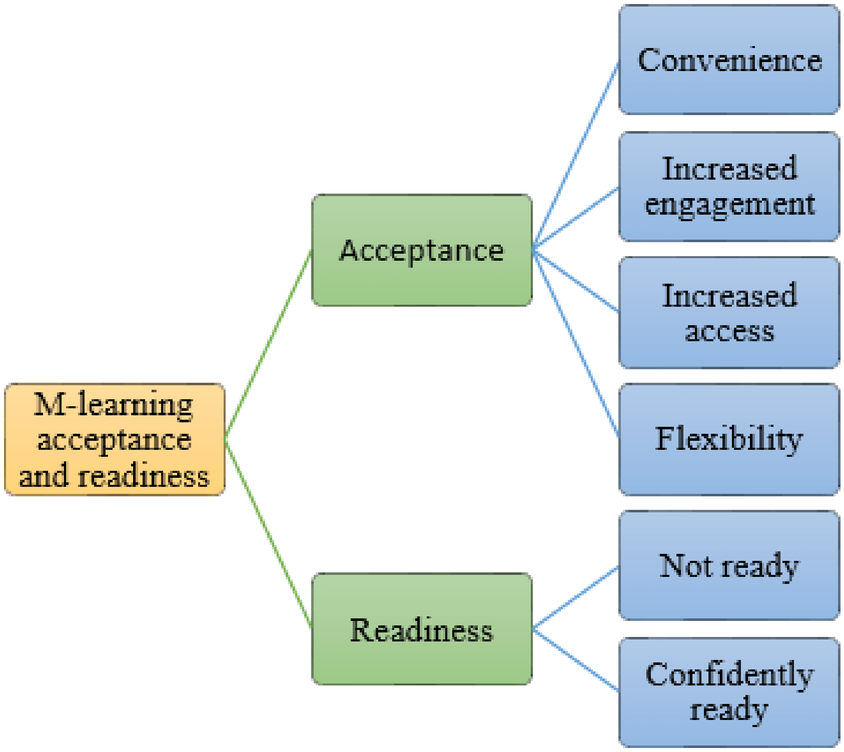


Figure 7. 8 Students' acceptance of and readiness for m-learning (by researcher)

Section 7.3 has shown that research questions RQ1, RQ2 and RQ3 are all addressed in regard to the six aspects of the mobile learning model for Zimbabwe universities as all three questions tick all the boxes of these aspects as shown in Table 7. 5.

Table 7. 5 Answering research questions RQ1, RQ2 and RQ3

M-learning readiness	**M-learning issues**	**M-learning challenges**	**Factors influencing m-learning adoption**	**Pedagogy**	**M-learning characteristics**
✓	✓	✓	✓	✓	✓

7.3.4 RQ4: What are the recommendations for mobile learning in tertiary institutions in Zimbabwe?

Several recommendations are made as a direct result of the findings of this study. They are presented below.

7.3.4.1 Improve infrastructure

In view of the findings reported in chapters 4, 5 and 6, there is a need to improve the infrastructure in Zimbabwe tertiary institutions. A lack of the requisite infrastructure will hamper m-learning initiatives (Lamptey and Boateng 2017; Asiimwe, Grönlund and Hatakka 2017; Ajayi, Ayo and Olamide 2019). The impact of inadequate infrastructure on m-learning was explored in section 2.9.1. In section 7.3.2, the stakeholders discussed the lack of adequate infrastructure as a challenge for m-learning. In a model for m-learning in Zimbabwe universities, infrastructure is placed in the blue column as an m-learning challenge. It is advisable that the importance of adequate infrastructure should continue to be emphasised. In Zimbabwe, there is need to improve the technological infrastructure for more stable Internet connectivity. It is also important to have reliable power sources for m-learning implementation to be successful as unreliable power supplies affect connectivity.

7.3.4.2 Access to appropriate devices

Chapters 4, 5 and 6 revealed that some students do not have access to a suitable mobile device that enables them to adopt m-learning. The chapters also indicated some students are unable to afford suitable mobile devices for m-learning. Although most students have access to at least one mobile device, not all mobile devices are suitable for m-learning activities (section 7.3.1.1). Affordability of mobile devices remains relative. For mobile technologies to be viable in education, the mobile devices should be suitable for the task and should be within reach for the learners. It may be useful for tertiary institutions to have schemes for learners to assist with essential study costs to enable them to access suitable mobile devices. This will encourage more learners to adopt m-learning and curb equity issues that are of concern to most stakeholders (section 7.3.2).

7.3.4.3 Dedicated team (technical staff and designers) for m-learning

Using mobile technologies for learning with devices such as smartphones or tablets will be different from using computers or laptops. Mobile learners will require immediate responses. It will be helpful to have a dedicated team that examine the technical aspects and the design of m-learning activities. This team will streamline the mobile experience to ensure speed and assist with dividing into suitable chunks that learners can access at one time. Chapter 5 and Chapter 6 have shown that learners are concerned with the quality of learning as well as poor learning habits when using mobile technologies.

It would be helpful to have a dedicated team that ensure that m-learning activities are engaging, enable feedback, and benefit learners. Feedback capture will enable learners to report or ask questions on learning material, thus putting learners at ease, particularly those who are concerned about the transition from the traditional approach (Section 7.3.3.2).

7.3.4.4 Active learning and innovative learning and teaching practices via m-learning

Chapter 5 has demonstrated that learners who have had exposure to m-learning are eager to embrace m-learning because it offers dynamic learning. Some learners have had m-learning experiences with lecturers using different applications which they found increased their engagement (section 7.3.3.1.2). Chapter 4 has shown that some instructors are making efforts to incorporate m-learning activities in their teaching. However, most of these activities are passive learning activities as discussed in section 4.5.9.1. It is essential to introduce active learning activities using m-learning beyond passive activities like the dissemination of reminders or notes so that students become more engaged in their learning. This active learning will be a product of innovative teaching and learning practices, so it is advisable that instructors be equipped to know how they can deliver their m-learning materials in a manner that is more engaging and promotes active learning. Instructors will need to tap into the learning theories to ensure the active learning activities and innovative practices are not a matter of just adding technology to learning. The importance of m-learning being underpinned by learning theories is explored in section 2.4.1. It is advisable that m-learning activities continue to capture the essence of learning, by utilising technology to enhance the teaching and learning process.

7.3.4.5 Establishing an independent monitoring body for m-learning

Successful m-learning implementation on a large scale will require independent monitoring. Monitoring and evaluation will help stakeholders assess what difference m-learning makes and provides vital information that can assist on how and where to improve. Monitoring and evaluation could be done by an independent body which is likely to be objective. Faculty heads are keen for monitoring and evaluation of m-learning see section 7.3.1.7.2. Tracking and assessing m-learning will assist stakeholders to determine whether any changes need to be made and understand what is being achieved through m-learning.

A summary of the recommendations for m-learning implementation in Zimbabwe tertiary institutions is given in Figure 7. 9.

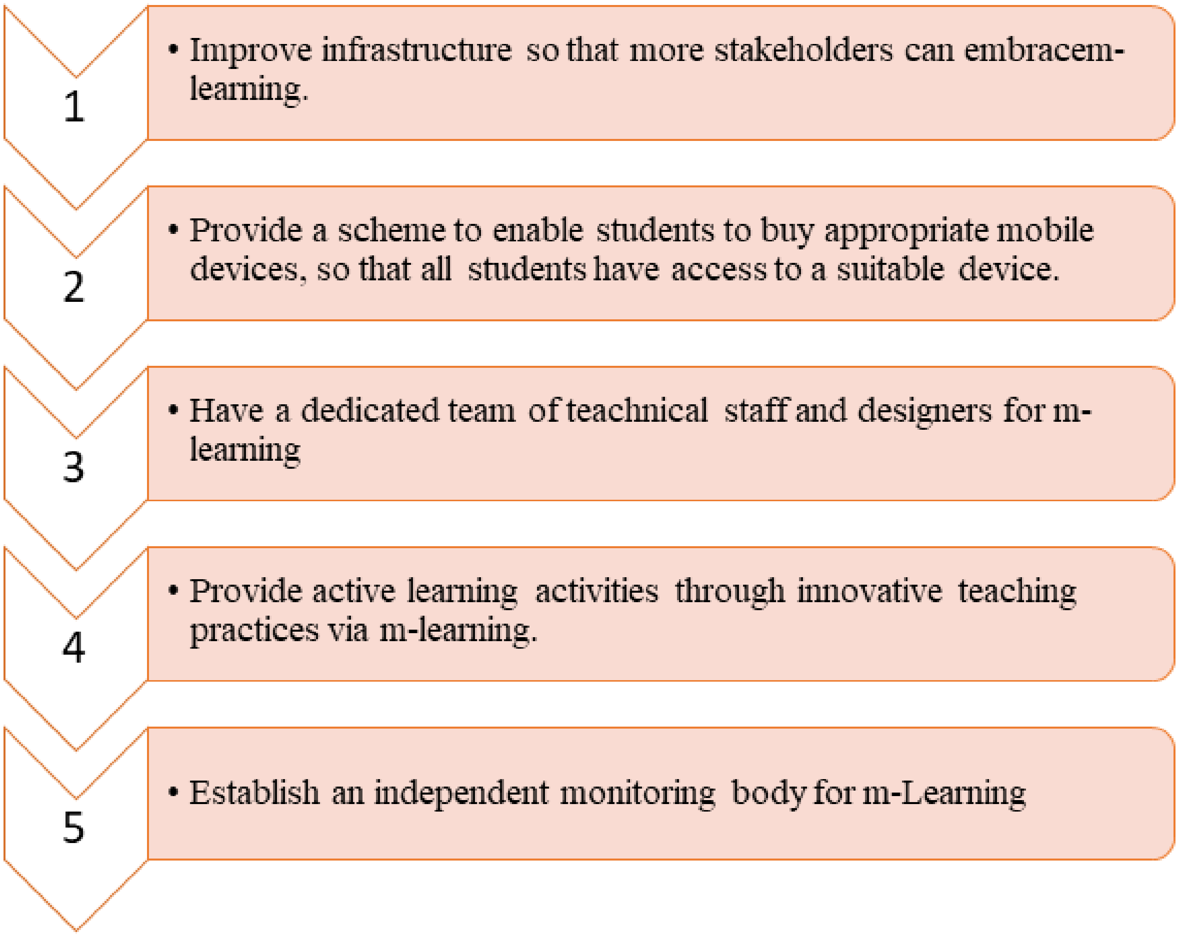


Figure 7. 9 Summary of recommendations for mobile learning in tertiary institutions in Zimbabwe

7.4 Research contributions

The research contributions for this study are two-fold theoretical and practical.

7.4.1 Theoretical implications

This study contributes to theoretical knowledge about various factors determining the successful implementation of m-learning in universities, both generally, and more specifically in relation to the mainstream higher education context of Zimbabwe. The findings of this study contradict earlier literature in regard to cheaper mobile phones being a factor influencing m-learning adoption in developing countries section 7.3.1. In this study, it is the accessibility of appropriate mobile devices that influences m-learning adoption. Although most learners have access to a mobile device, most learners are not keen to adopt m-learning if their device is deemed unsuitable.

This study has identified six factors that influence m-learning adoption in Zimbabwe universities discussed in Section 7.3.1. These are:

- Usability
- Culture
- Requisite infrastructure
- Institutional support
- Accessibility of appropriate devices
- Acceptability of m-learning

The implementation and adoption of m-learning in developing countries like Zimbabwe is complex. Apart from the established m-learning challenges such as inadequate infrastructure, cost, and lack of policy (section 2.9), there are some other challenges of m-learning that are specific to Zimbabwe:

- M-learning awareness is varied within and across stakeholders (sections 4.5.8.2, 4.5.10.4 and 4.6.4.2). This study has shown that in developing countries like Zimbabwe creating m-learning awareness amongst the stakeholders will likely result in more stakeholders embracing m-learning.
- Equity issues are generally of importance to all stakeholders, stakeholders are not willing to embrace a mode of learning that will disadvantage other learners (section 7.3.2.3.2 and section 7.3.3.1). So, accessibility of appropriate mobile devices has huge impact on influencing the adoption of m-learning.

This study is one of the first few to explore m-learning in Zimbabwe on a large scale. The study employed a mixed-methods approach which, despite its own limitations, has proved appropriate for investigating m-learning in Zimbabwe. The approach employed was rigorous and involved a three-phase data collection process and data analysis. The three-phase approach allowed for triangulation, increasing confidence in the research data. The mixed-methods approach was a holistic approach as data was collected from several stakeholders and then analysed, which led to the development of a model for m-learning in Zimbabwe universities.

This is one of a few studies that has attempted to use a large-scale online survey in Zimbabwe. Although the online survey was partially successful in this study due to the length of the survey, shorter online surveys in Zimbabwe are likely to be received favourably. Literature generally shows that online surveys result in low response rates (Bryman 2016; Couper and Miller 2008; Fan and Yan 2010; Scott et al. 2011; McPeake, Bateson and O'Neill 2014; Evans and Mathur 2018; Hohwü et al. 2013). Based on the number of participants who viewed and/or attempted to complete the survey online (219) with only 60 completing the online survey, there is evidence that online surveys can be successful in developing countries if they are not too long. With few m-learning studies emanating from developing countries, this study adds to the body of knowledge. This is one of the first studies investigating m-learning on a large scale in Zimbabwe.

7.4.2 Practical implications

This thesis has developed a model for m-learning in Zimbabwe universities. The model can be of value to various m-learning stakeholders. It is anticipated that a model for m-learning in Zimbabwe universities will encourage m-learning implementation and adoption in Zimbabwe and will be adopted by other educational institutions in Zimbabwe. The model for m-learning in Zimbabwe universities provides guidelines for instructional designers and lecturers when designing m-learning activities and blending these with existing teaching and learning practices. Also, the Zimbabwean government's education department, the universities, and various other stakeholders may find this model useful as it enables students to experience dynamic learning anywhere anytime. The study further contributes to theoretical knowledge by submitting recommendations for the implementation of m-learning in developing countries similar to Zimbabwe. The recommendations can be used by stakeholders in these countries when planning the implementation of m-learning in their own tertiary education institutions.

7.5 Research limitations

Although this study makes several contributions to this field of research, it is not without limitations. These are discussed below.

7.5.1 Limited access to data

The main limitation of this study is that it did not include all the key stakeholders involved in m-learning in Zimbabwe. For the qualitative data, the participation of key stakeholders was sought in government departments, namely the Ministry of Higher Education and the Ministry of ICT. The researcher was unable to gain access to any officials in the two ministries, despite making several efforts via different means of communication.

For the quantitative data, the researcher originally intended to gather data from a sample of 397 students; however, data was collected from only 358 participants. It was a challenge to find participants willing to complete the survey given the socio-economic challenges in Zimbabwe. While potential participants wanted to help, most seemed preoccupied in efforts to make economic ends meet, which meant completing a survey was a luxury they could not afford. The time constraints imposed on the research made it difficult for the researcher to recruit more students for the survey, particularly since the initial online survey was not too successful. The logistical challenges of shipping questionnaires between Africa and Australia and the actual data collection process were more time consuming than anticipated.

Despite the limitations of not being able to interview some key stakeholders and reaching the intended student sample size, enough data was generated to enable an analysis that provided significant theoretical and practical implications in regard to m-learning implementation and adoption.

7.5.2 Study was not specific re. Type of mobile technologies

This study was not specific regarding the type of mobile technologies used by Zimbabwe students. Mobile devices include smartphones, tablets, laptops, Ipads, and gaming devices. This study, in investigating factors that influence m-learning adoption and other aspects of m-learning such as m-learning characteristics and m-learning challenges, was not concerned with a specific type of mobile device or the functionalities of various devices. A mobile device with more computational power is likely to improve the m-learning experience than will a low-end mobile device.

7.5.3 Study was cross-sectional

This study investigated various stakeholders' perceptions of and attitudes towards m-learning at a single point in time. Perceptions do change over time as individuals gain experience or become more exposed to the phenomenon being investigated (Venkatesh et al. 2003). The change in perceptions has implications for researchers and practitioners who may attempt to predict who might be interested in embracing m-learning over time.

7.6 Future research

The outcomes of this study indicate that Zimbabwe could benefit from implementing m-learning on a large scale. There are several areas where the work undertaken in this study could be further developed and applied. Future research on m-learning in Zimbabwe universities could consider several directions:

- Investigation of m-learning on a larger scale by including more universities to acquire a better understanding of all aspects of m-learning.
- Investigation of social networking platforms popular with Zimbabwe tertiary students such as WhatsApp, and their potential as learning spaces.
- The model developed could be evaluated to see if it is applicable to different levels of learning such as secondary or primary school.

7.7 Conclusion

This concluding chapter presents a summary of the study, answers the research questions, and proposes a model for m-learning in Zimbabwe universities. The thesis explains factors that influence the adoption of m-learning in Zimbabwe higher education. The five factors are (1) accessibility of appropriate mobile devices, (2) culture, (3) usability, (4) requisite infrastructure and (5) institutional support. The stakeholders' perceptions of and attitudes towards m-learning have been discussed and considered prior to developing an m-learning model for Zimbabwe's higher education sector. Acceptability of m-learning is heterogeneous within and across the different stakeholders. Most stakeholders are keen to adopt m-learning based on the benefits of m-learning. Some stakeholders are not keen to embrace m-learning at the moment because of (1) inadequate infrastructure, (2) lack of training, (3) inadequate technical support and (4) impact on teaching and learning.

An examination of learners' level of readiness and acceptance of m-learning has provided a better understanding of how m-learning should be implemented in Zimbabwe. The lack of exposure to m-learning for some students makes them ill-prepared for m-learning. Yet, those students who have had exposure to m-learning are confident that they are ready for m-learning. Students are concerned about equity issues. Students are aware that not all their peers will have access to an appropriate device and are concerned about the associated disadvantages of not having a suitable device.

The conceptual models developed explain the outcomes from the data collection and analysis from the different stakeholders. To develop a model of m-learning in Zimbabwe higher education required a careful selection and employment of appropriate research methods. The exploratory approach applied to this research has proved to be valuable. The findings of this research confirm the advantages of using the mixed-methods approach examined in this thesis.

Recommendations were derived from a model of m-learning in Zimbabwe higher education to assist stakeholders with the implementation of m-learning in tertiary institutions. The recommendations are (1) improving the infrastructure, (2) ensuring access to appropriate mobile devices, (3) having a dedicated team for m-learning, (4) introducing active learning and innovative learning and teaching practices via m-learning and (5) establishing an independent monitoring body for m-learning. The theoretical and practical contributions offered by this study have been explained, and the limitations of this study have been acknowledged.

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Appendix A: Sample letter of permission to conduct research

60B Tain Street
Ardross
6152 WA
Australia

The Registrar
Bindura University of Science and Education
741 Chimurenga Road off Trojan Road,
Bindura
Zimbabwe

07 July 2017

Dear Sir/Madam,

REQUEST FOR PERMISSION TO CONDUCT RESEARCH at BUSE

My name is Lydia Maketo, and I am an Information Systems student at Curtin University Australia. The research I wish to conduct for my Doctoral thesis involves mobile learning at tertiary institutions in Zimbabwe. This project will be conducted under the supervision of Dr Tomayess Issa (Curtin University Australia).

I am hereby seeking your consent to approach some key stakeholders in tertiary education in your institution such as lecturers, librarians, administrators, and IT support for this project.

I have provided you with a copy of my dissertation proposal which includes copies of the measure and consent and assent forms to be used in the research process, as well as a copy of the approval letter which I received from the Curtin University Research Ethics Committee (Human).

If you require any further information, please do not hesitate to contact me on +61410277499, or via email: Lydia.maketo@student.curtin.edu.au. Thank you for your time and consideration in this matter.

Yours sincerely,

Lydia Maketo

Appendix B: Consent form for qualitative data collection

HREC Project Number:	HRE 2017-0301
Project Title:	Mobile learning model for Zimbabwe higher education
Chief Investigator:	Dr Tomayess Issa, Senior Lecturer
Student researcher:	Lydia Maketo
Version Number:	2
Version Date:	21 February 2018

- I have read, the information statement version listed above and I understand its contents.
- I believe I understand the purpose, extent and possible risks of my involvement in this project.
- I voluntarily consent to take part in this research project.
- I have had an opportunity to ask questions and I am satisfied with the answers I have received.
- I understand that this project has been approved by Curtin University Human Research Ethics Committee and will be carried out in line with the National Statement on Ethical Conduct in Human Research (2007).
- I understand I will receive a copy of this Information Statement and Consent Form.

Participant Name	
Participant Signature	
Date	

Declaration by researcher: I have supplied an Information Letter and Consent Form to the participant who has signed above, and believe that they understand the purpose, extent and possible risks of their involvement in this project.

Researcher Name	
Researcher Signature	
Date	

Note: All parties signing the Consent Form must date their own signature.

ONLY USE IN PROJECTS WITH IMPLIED CONSENT

Please insert the following tick box at the top of your questionnaire.

☐ I have received information regarding this research and had an opportunity to ask questions. I believe I understand the purpose, extent and possible risks of my involvement in this project and I voluntarily consent to take part.

EXAMPLES OF OPTIONAL CONSENT TICK BOXES

If you are offering consent choices, information about each option MUST be described in Section "What am I being asked to do?" of the Information Statement under a heading titled OPTIONAL CONSENT

☐ I do	☐ I do not	consent to being video recorded

☐ I do	☐ I do not	consent to being audio-recorded

☐ I do	☐ I do not	consent to being photographed

☐ I do	☐ I do not	consent to data linkage

☐ I do	☐ I do not	consent to be contacted about future research projects that are related to this project

☐ I do	☐ I do not	consent to the storage and use of my information in future ethically approved research projects related to this (project/disease)

Appendix C: Email interview letter

LM

Lydia Maketo
Wed 11/10/2017 13:28
To:

Consent Form.pdf 231 KB	Participation Information Stat... 184 KB	Lecturers' Questions.docx 21 KB	Africa University permission t... 466 KB

4 attachments (902 KB) Download all Save all to OneDrive - Curtin University of Technology Australia

Dear Mr

I hope this email finds you well. I am a PhD student at Curtin University researching Mobile learning at tertiary institutions in Zimbabwe, with the intention of coming up with a Mobile-learning model for Zimbabwe tertiary institutions. I would like to get your thoughts, opinions and insights on m-learning in Zimbabwe as a lecturer. I have attached a questionnaire, information sheet and consent form as well the permission to conduct research at Africa University.

I hope you can assist by completing the questionnaire. You can do this by completing the attached Word document then email it to me or respond to the questions via the online link provided below, which I will automatically receive when you are done.

I will greatly appreciate your assistance with my research.

Survey link https://curtin.au1.qualtrics.com/jfe/form/SV_eu0rtjecIW7Y0dv

Yours Sincerely

Lydia Maketo

Appendix D: Interview questions

Library staff

1. How would you describe the information resources and their availability to students and lecturers?
2. Describe the digital services offered by the library in terms of availability.
3. Does the library offer content and services suitable for mobile devices? Explain
4. Will the use of mobile devices affect students' access to library resources?
5. What pros and cons are there in using mobile devices?
6. How might the use of mobile devices affect student learning?

What are your thoughts/expectations if mobile learning is introduced into a university environment in Zimbabwe?

Faculty heads

1. Share your experiences/thoughts and concerns about using a mobile device for teaching and learning.
2. Would you be interested to incorporate mobile learning in the courses offered at your institution? Why or why not? Discuss.
3. To create teaching and learning content for mobile devices, how much support can the university provide in terms of training and technical support to teachers and students?
4. Using mobile devices for teaching and learning, students and teachers will be able to access and update learning resources from anywhere and at any time; comment on this concept of flexibility in learning.
5. Using mobile devices for learning will allow students and lecturers to collaborate and communicate with each other when they are participating in the learning activities such as fieldwork and completing projects or assignments. Comment on this statement.
6. Using mobile devices for learning may assist the students to gather additional information during fieldwork or learning excursions. Discuss this statement.
7. Using mobile devices for teaching and learning will allow students to be capable of self-study or self-learning without much intervention from lecturers. Comment on the statement.

Lecturers

1. In the past few months, how often do you need technical (or IT) support when browsing the internet using your mobile device, for example accessing emails or engaging in social networking?

2. Give your opinions on capabilities of using mobile devices in teaching and learning.

3. What are the constraints of using mobile devices in teaching and learning?

4. What are the current needs for professional development on mobile learning?

5. State some of the teaching and learning activities you can perform using your mobile device.

6. If some part of your courses were offered in a mobile learning mode, would you be interested to teach that course? Why?

7. To create teaching and learning content for mobile devices, what are students and teachers' needs in terms of training and technical support?

8. Using mobile devices for teaching and learning enables students and lecturers to access and update learning resources from anywhere anytime; comment on this concept of flexibility in learning.

9. Using mobile devices for learning will allow students and lecturers to collaborate and communicate with each other as they participate in learning activities such as completing projects or assignments. Comment on this statement.

10. Using mobile devices for teaching and learning will allow students to be capable of self-study or self-learning without much intervention from lecturers. Comment on the statement.

11. Give general comments about adopting mobile learning in your discipline.

12. What are your thoughts/expectations if mobile learning is introduced into a university environment in Zimbabwe?

University IT support

1. How many students and teachers connect to the university network from mobile devices?

2. How often do students and teachers require technical (or IT) support when browsing the internet using mobile devices?

3. Discuss any difficulties that students and teachers may face when using mobile devices/technologies for learning?

4. If some part of a course is offered in a mobile learning mode in the university, is it possible to provide seamless integration of mobile devices with Learning Management System?

6. To create teaching and learning content for mobile devices, would your department be able to train teachers and provide IT support?

5. What are your thoughts/expectations if mobile learning is introduced into a university environment in Zimbabwe?

Appendix E: Letter to students

Dear Sir/Madam,

I am conducting research examining students' attitudes toward Mobile learning (m-learning) in Zimbabwe tertiary institutions. Your assistance in this research would be greatly appreciated and will contribute to the success of its findings. This research involves a survey, which will take up to ten minutes to complete. This survey contains thirty questions. Please read each statement and then circle the number or tick the box, according to how you feel. I would appreciate it if you can complete this survey within a week if possible, however, if this is too short a space of time, please respond as soon as you are able.

Participation in this research is completely voluntary and your responses will be completely anonymous. Participants may withdraw at any time without prejudice or negative consequences, and do not need to provide a reason. By completing the survey, you are consenting to participate. Any information provided by you through the survey will be held as strictly confidential. Information will not be disclosed to any parties besides the researchers, unless required to do so by law. Finally, the researchers will ensure that published material will not contain any information that can identify you or your institutions. We encourage you to participate because this research will provide valuable insights into students' reactions toward m-learning adoption in the higher education sector in Zimbabwe.

Your interest and consideration are greatly appreciated. If you need any additional information from us, please contact me via email lydia.maketo@postgrad.curtin.edu.au or Tomayess.Issa@cbs.curtin.edu.au (+61 8 9266 7682). The Curtin University Human Research Ethics Committee (HREC) has approved this study (HREC number HRE 2017-0301). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

Thank you in advance.

Yours faithfully,

Lydia Maketo

Appendix F: Library staff first impression notes

Respondent	First impression notes
Library_Staff_1	Resources are available. However, access to online materials often hampered by **poor Internet connections**. More resources could be made available online besides website. Sees potential in using mobile devices. Cons to using mobile devices include eye fatigue, cost, poor connectivity, lack of skills, **digital divide**.
Library_Staff_2	Substantial resources, with online resources accessible via the library LAN and on mobile devices. Potential of using mobiles seen through lens of portability, access, information sharing. Disadvantages cost, loss and theft **heavily dependent on electricity and Internet which are not reliable.**
Library_Staff_3	Fair distribution of resources. Most resources online and can be accessed using **smartphones.** Cons to using mobile devices accessing inappropriate material, **distraction from academic work,** cyber bullying. Advantages increased access, **social learning.** Potential lies in increased access, and convenience of not physically being in the place to access content.
Library_Staff_4	Relevant resources that are available online. Potential of using mobile devices include increased communication, higher pass rate, **increased digital literacy**. Disadvantage **mobile devices used for social activities not academic work.**
Library_Staff_5	Comprehensive resources available online, which can be accessed using mobile devices. Increased access to local and global content. Pros mobile devices not limited by time or distance, **information sharing**, convenience, access to global content that is **current and authoritative**. Drawbacks prone to theft, **dependence on electricity for charging.**
Library_Staff_6	Most resources are online. Use **of social networks** for communication and updates. **Mobile devices differ in computing power,** students cannot utilise mobile devices in the same way. Not all students can afford powerful mobile devices. Distraction from academic work. Poor Internet connectivity. **Mobile devices prone to virus attacks**.
Library_Staff_7	Comprehensive resources that can be accessed using mobile devices. Access via mobile devices **heavily depends on Internet connection.** Potential seen in easy access to resources, **flexible learning** and **independent learning**. Disadvantages of using mobile devices included **batteries running out** and that **response from Internet can be slow.**
Library_Staff_8	Diverse electronic resources, however access to the available resources **hampered by inadequate equipment**. Drawbacks of mobile devices **poor concentration** due to social media. Potential to **democratise education** across the country, **reduce costs**.

Appendix G: Faculty heads' first impression notes

Respondent	First impression notes
Faculty_head_1	Mobile devices are perceived as a goods of **convenience** not luxury. M-learning **slowly** becoming **popular** with students. M-learning **awareness** generally **low** among students.
Faculty_head_2	M-learning is the **way to go**. It can advance the institution's **agenda** and fulfil institution's **mandate.** Institution should **provide** the **requisite resources.**
Faculty_head_3	Need for **funding** and supporting **policies**. M-learning allows for **flexible** learning and **integration of ICT** with teaching and learning
Faculty_head_4	M-learning allows for **blended** and **flexible** learning. M-learning requires buy in from **management**. Issues of **connectivity** may **hamper** m-learning.
Faculty_head_5	M-learning good if **resources** are available. **Training** required for both students and lecturers.
Faculty_head_6	Institutions **should** provide the IT resources **required** for m-learning. M-learning offers flexibility and convenience.
Faculty_head_7	Institution has predominantly been running **classroom-based** learning, means changing to new mode. Challenge to **separate** learning and entertainment for learners.
Faculty_head_8	Students need to be **disciplined** when using mobile devices. Most students have mobile phones which is a **powerful tool** in teaching and learning.

Appendix H: Lecturers' first impression notes

Respondent	First impression notes
Lecturer_1	M-learning has a lot of potential but is heavily dependent on **Internet connectivity**. **Distractions** from academic work is a constraint. M-learning allows one to do everything one would normally do using a computer. **Need for training**. M-learning **reduces contact time** with learners which is a positive, however some subjects require a lot of contact time.
Lecturer_2	M-learning is very convenient; however, it is **more suited to self-actualised learners** who do not depend on supervision from instructors. M-learning has potential **it is convenient**, allows for **flexible learning**. **Obstacles** include low battery life of devices. There is need for user **friendly apps and interfaces.**
Lecturer_3	Most lecturers **lagging behind** in use of mobile devices as teaching aids due to **lack of training**. Lecturers **incur costs** for Internet connectivity. Cost of data is too high. Potential **resistance** from management, need for **government and institutional support**. M-learning will free up time for instructors to engage in research.
Lecturer_4	**Huge potential** offered by m-learning **on condition** there is **good Internet connectivity** and **discipline on use of mobile** technologies. Need for **grooming for "older" lectures** to accept new technologies in learning and teaching. M-learning may **benefit students who are self-starters** more than those who want to be provided with everything.
Lecturer_5	Most learners **do not have access to mobile devices** and most will **divert to non-academic activities**. M-learning suited to **adult learning** in which lecturers **provide guidance** not drilling learners. M-learning will be well-received but there is need to **improve network coverage.**
Lecturer_6	Most instructors **have technical capabilities** to activate teaching and learning using mobile technologies, they require **induction and familiarisation** with relevant applications. There is need for training for **the older generation** lecturers. M-learning enables seamless learning. With m-learning lecturer plays role of **moderator/guide**.
Lecturer_7	Students are likely **to switch to non-academic activities**. **Not** all students have **access to mobile devices**. M-learning allows learners to **easily get engaged** with academic material, makes it **easier to explain** concepts. Learners are **attached to mobile devices** and being able to access leaning materials on these devices may encourage learners to **take an initiative** in learning.
Lecturer_8	Technical support is **not willing to assist**. BYOD for lecturers is unfair. Need for **basic training** such as creating slides and animation. M-learning requires **a firm reading culture** from students, currently students are **driven by marks** rather than learning. M-learning will be a **good improvement** from traditional approach.
Lecturer_9	**Acceptance of m-learning** will depend **on planning, resources and technical support. Some constraints** to m-learning are that some documents cannot be downloaded on mobile devices, need for appropriate mobile devices, broadband Internet access. There is need **for training for learners and lecturers**.
Lecturer_10	Some instructors **are illiterate** regarding use of mobile devices for teaching and learning. Mobile technologies **not supportive of programming** and **cannot store large** databases. Other limitations of mobile devices **are low storage power** and **low processing power** for heavy applications.

Lecturer_11	M-learning creates a **more versatile learning environment**. Care should be taken that students **do not misuse** mobile technologies. Concerns about **plagiarism**. Traditional approach to teaching and learning **has limitations**. M-learning allows instructors **to engage** with learners in a more **relevant and contemporary** way.
Lecturer_12	There is need for **skill acquisition** for contemporary approaches to teaching and learning using mobile technologies. Need for **overhauling infrastructure** to improve Internet access. Students have **expressed challenges on using mobile devices** with on-line courses.
Lecturer_13	Mobile technologies are mostly used for social networking. Current teaching methods do note promote use of mobile technologies. M-learning develops independent learners, equipped for problem-solving. M-learning makes learning more enjoyable.
Lecturer_14	Instructors require more **technical knowledge**. Students **do not have appropriate mobile devic**es for smooth leaning and teaching. Data **is expensive**. Both learners and lecturers can get **distracted** using mobile devices. **The erratic Internet access is discouraging** to the point of not wanting to utilise m-learning
Lecturer_15	Although it has potential, may not be accepted in Zimbabwe. Need for policy change. There is need for resources that are compatible with mobile devices. Concern that students may ask others to provide answers for them. Need for acceptance that education through the non-traditional approach has same value e.g. online degrees
Lecturer_16	There is need **for training for both lecturers and learners**, with proficiency in software and programmes for lecturers. M-learning is a good **idea in theory**. M-learning **easy to use** after training. There is need **for resources at affordable prices** e.g. affordable mobile devices.
Lecturer_17	M-learning will **transform** higher education sector, improving the learning process for **both learners and instructors**. There are concerns on how **social media can be a distraction** to teaching and learning. There is a concern on whether there is **adequate bandwidth** to support m-learning. Mobile technologies are **affordable** to the learners.
Lecturer_18	A major constraint **is Internet access** for both learners and lecturers. There is need for **training for both learners and lecturers** on how to use the online platforms. M-learning good where there **is reliable Internet** access. There is need for **affordable** mobile devices and **responsive technical support.**
Lecturer_19	Some learners **do not have relevant devices.** There is need to be **familiar with devices** in the Zimbabwean social and economic environment. Learners need to be equipped with **appropriate skills** to engage with mobile technologies for learning. There is need to **train lecturers** on how **to maximise the use of mobile devices for teaching and learning.**
Lecturer_20	Current **legislation does is not be supportive** of m-learning. Mobile technologies have been promoted **for communication** and **money transfer**. Acceptability in general may be a challenge. Poor connectivity. Concerns that most learners do not have the **discipline of self-learning**. Students are mostly from government agencies which are not **amenable to this method** of teaching and learning.

Lecturer_21	M-learning requires significant investment. Not sure of capabilities of m-learning. There is need for training. Not interested in teaching using m-learning mode because of lack of resources.
Lecturer_22	M-learning **useful** when teaching new generation of students that **e-compliant**. Learners **enjoy learning** when using mobile technologies. Training essential to **minimize mistakes and frustrations.** Use of mobile devices **combines leisure and learning. Connectivity** and **power outages** are a big challenge.
Lecturer_23	The main challenges are that not all people have capable devices, power outages, poor infrastructure, not all instructors can generate content to distribute on mobile devices. Need for training for both learners and instructors. M-learning will encourage self-learning.
Lecturer_24	M-learning will present diverse learning opportunities which are expected to produce better results. There is a need to embrace mobile devices for learning and teaching. Although mobile devices have limitations, they can still enhance teaching and learning.
Lecturer_25	Lack of **Internet access** is a major problem. There is need for **comprehensive training** in all aspects. Will be keen to utilise m-learning **only if training is provided**. Use of mobile devices is **convenient** but these devices can **be abused**. M-learning could reduce congestion at universities.
Lecturer_26	Current trend leans more to **mobile device usage** rather than desktop computers. Students **prefer to use mobile devices** to computers. Training is a **key issue**. Would use m-learning mode because **of the potential these devices** have in teaching and learning. Most learners have already embraced mobile devices and use them daily.
Lecturer_27	There is need for a change in **attitude** from lecturers. Students need to be taught **meaningful use** of mobile devices. M-learning will **benefit self-motivated learners**. Currently learners spend too **much time on social media**. They may be **chaos** at the beginning as students begin to learn how to **meaningfully** use mobile devices.
Lecturer_28	Although m-learning has great potential is very much underutilized. Major obstacles are slow Internet connections and high cost of data and relatively high cost of mobile devices. There is need to produce teaching and learning content suitable for mobile devices. There is need for training and technical support for lecturers.
Lecturer_29	Some students do not have **prior exposure** to technology. Lecturers need to **understand the frameworks and platforms** used to create content. M-learning will enable more **student involvement** in the learning process. M-learning does **not limit consultation to office hours** and **ideas are communicated as and when they come.**
Lecturer_30	Some students **cannot afford to own** mobile devices. There are **Internet challenges** sometimes on university campuses and some students do not have Internet access at home. The **economic challenges** faced by the country make it difficult to have adequate resources. Current crop of students needs **strict monitoring** and may not be **capable of self-learning**. M-learning may assist in creating **freeing up time** for lecturers to conduct research.

Appendix I: IT Support staff first impression notes

Respondent	First impression notes
IT_Support_Staff_1	Students often **encounter problems** when there is a **technical** problem with the **system**.
IT_Support_Staff_2	Students and teachers **rarely** require technical support, problems are often associated with **forgotten passwords. Infrastructure** needs to be upgraded.
IT_Support_Staff_3	On average have **15 students** and/or teachers requiring technical support daily. Problems on using mobile technologies have to do with **lack of know-how**.
IT_Support_Staff_4	**Around 15-20 students** and or lecturers require technical support on a daily basis. **Servers refuse connections** to some applications and technologies used by students and lecturers.
IT_Support_Staff_5	Most students and teachers are not able to configure mobile devices at first use. There is a training facility for lecturers.
IT_Support_Staff_6	Login issues at the start of the semester-these include forgotten or lost credentials. **Training and support** are provided **on request**.

Appendix J: Focus group questions guide

Focus group questions guide
1. In the past few months, how often do you need technical (or IT) support when browsing the internet using your mobile device, for example accessing emails or engaging in social networking? 2. How much time do you spend on Internet on your mobile device? 3. What do you think are the advantages of m-learning? 4. What are the limitations of using mobile devices in learning? 5. What are some of the learning activities you can perform using mobile devices? 6. Share your experiences using a mobile device for learning 7. While using mobile devices for learning, one can easily be distracted, often moving from academic content. Comment on this. 8. M-learning requires students to have self-learning skills without constant intervention from lecturers. Do you think students are ready for this kind of learning? Explain your answer. 9. What is your opinion about using a mobile device to collaborate with peers and teachers when you are participating in the learning activities such as fieldwork, projects or assignments? 10. If some part of your courses were offered in a mobile learning mode, would you be interested to enroll in that course? Why? 11. What are your concerns when using a mobile device for learning? 12. In summary, what are your thoughts/expectations if mobile learning is introduced into a university environment in Zimbabwe?

Appendix K: Survey Questions

M-learning Survey Zimbabwe Tertiary Institutions

Dear Sir/Madam,

I am conducting research examining students' attitudes toward Mobile learning (m-learning) in Zimbabwe tertiary institutions. Your assistance in this research would be greatly appreciated and will contribute to the success of its findings. This research involves a survey, which will take up to ten minutes to complete. This survey contains thirty questions. Please read each statement and then circle the number or tick the box, according to how you feel. I would appreciate it if you can complete this survey within a week if possible, however, if this is too short a space of time, please respond as soon as you are able.

Participation in this research is completely voluntary and your responses will be completely anonymous. Participants may withdraw at any time without prejudice or negative consequences, and do not need to provide a reason. By completing the survey, you are consenting to participate. Any information provided by you through the survey will be held as strictly confidential. Information will not be disclosed to any parties besides the researchers, unless required to do so by law. Finally, the researchers will ensure that published material will not contain any information that can identify you or your institutions. We encourage you to participate because this research will provide valuable insights into students' reactions toward m-learning adoption in the higher education sector in Zimbabwe.

Your interest and consideration are greatly appreciated. If you need any additional information from us, please contact me via email lydia.maketo@postgrad.curtin.edu.au or Tomayess.Issa@cbs.curtin.edu.au (+61 8 9266 7682). The Curtin University Human Research Ethics Committee (HREC) has approved this study (HREC number HRE 2017-0301). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research

Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

Thank you in advance.

Yours faithfully,

Lydia Maketo

I have received information regarding this research and had an opportunity to ask questions. I believe I understand the purpose, extent and possible risks of my involvement in this project and I voluntarily consent to take part.

- ○ Yes
- ○ No

Q1. Gender

- ○ Male
- ○ Female

Q2. Please indicate your age

- ○ 17-21
- ○ 22-30
- ○ 31-40
- ○ 41-50
- ○ over 50

Q3. What is your main field of study?

- ○ Accounting
- ○ Economics and Finance
- ○ Information Systems
- ○ Information Technology
- ○ Computer Science
- ○ Management
- ○ Marketing
- ○ Health Sciences
- ○ Humanities
- ○ Art and Design
- ○ Science and Engineering
- ○ Agriculture and Forestry
- ○ Education
- ○ Other-please specify ____

Q4. Please select your highest level of education

- ○ Secondary school education
- ○ Diploma
- ○ Bachelor’s degree
- ○ Post Graduate Diploma
- ○ Master’s degree
- ○ PhD

Q5. Current study level

- ○ 1st year
- ○ 2nd year
- ○ 3rd year
- ○ 4th year
- ○ 5th year

Q6. Mobile use capabilities

- ○ Novice (less than 1 year)
- ○ Intermediate (1-3 years)
- ○ Advanced (more than 3 years)

Q7. What type of portable device do you own? (Select all that apply)

- ☐ Basic cell phone-for SMS and making calls
- ☐ Smartphone
- ☐ Tablet
- ☐ Laptop
- ☐ I do not own one
- ☐ Other (specify) (6) ____

Q8. What type of operating system do you have on your phone?

- ○ Apple iOS
- ○ Android
- ○ Windows

○ Blackberry

○ Other-please specify ____

Q9. Do you have internet access at home?

○ Have it

○ Don’t have it and don’t want it

○ Don’t have it and cannot afford it.

Q10. Do you have mobile internet access?

○ Have it.

○ Don’t have it.

Q11. I know what m-learning is.

- ○ Yes
- ○ No

Q12. How often do you use mobile applications?

- ○ Seldom (1-3 hours per month)
- ○ Sometimes (1-3 hours a week)
- ○ Frequently (1-3 hours per day)
- ○ Always (more than 3 hours per day)

Q13. For the following applications indicate frequency of use

	Always	Sometimes	Seldom	I do not use
WhatsApp	○	○	○	○
Twitter	○	○	○	○
Instagram	○	○	○	○
Facebook	○	○	○	○
You Tube	○	○	○	○
Snapchat	○	○	○	○
LinkedIn	○	○	○	○

Other-please specify	○	○	○	○

Q14. Which mobile device do you prefer to use for educational purposes?

- ○ Smartphone
- ○ Tablet
- ○ Laptop
- ○ Other-please specify ______________________________

Q15. Which of the following information resources do you currently access in on your handheld mobile device?

	Always	Sometimes	Seldom	Never
Audio clips	○	○	○	○
Educational material	○	○	○	○
Internet	○	○	○	○
Sports/News	○	○	○	○
Entertainment	○	○	○	○
Social networks (Facebook, WhatsApp)	○	○	○	○
Weather	○	○	○	○
Other-please specify	○	○	○	○

Q16. When do you use your mobile device for everyday studying purposes?

○ During lessons

○ Between lessons

○ For independent studying

○ Never use it for studying

Q17. When using mobile devices

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I experience unreliable internet connection	○	○	○	○	○
The Internet connection on my mobile is of low speed	○	○	○	○	○
The small keypad and screen size are a limitation for me to use a mobile device for learning	○	○	○	○	○
Using a mobile device for learning is a problem for me because of the limited memory and battery capacity	○	○	○	○	○
I find it hard to navigate and download educational	○	○	○	○	○

material using a mobile					
I struggle to keep the battery for my mobile device charged	○	○	○	○	○

Q18. Which of the following library services would you be interested in accessing on a hand held mobile device? (Select all that apply)

- ☐ Chat session with the librarians.
- ☐ Database search
- ☐ Book and movie reserves
- ☐ Library related video casts and podcasts
- ☐ Other-please specify ____

Q19. Which of the following information technology services would you be interested in accessing on a hand held mobile device? (Select all that apply)

- ☐ University email
- ☐ Instant messaging (texting) or WhatsApp with instructor
- ☐ Chat session with student services
- ☐ Search for courses

- [ ] Grades
- [ ] Other-please specify ____

Q20. Current use of mobile learning services

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I use m-learning services to check my academic calendar	○	○	○	○	○
I use m-learning services for alerts and warnings	○	○	○	○	○
I use m-learning service for course registration and time table	○	○	○	○	○
I use m-learning service to watch educational videos	○	○	○	○	○

and listen to audio lectures					
I use m-learning services to get soft copies of study materials	○	○	○	○	○

Q21. Which of the following learning resources would you be interested in accessing on mobile device? (Select all that apply)

- ☐ Lecture PowerPoint slides
- ☐ Audio recordings (e.g., recordings of lectures, school information)
- ☐ Videos (e.g., course related, recordings of lectures, school information)
- ☐ Digital copies of printed content
- ☐ EBooks
- ☐ Flashcards and other interactive educational games
- ☐ Hyperlinks to course related reference material
- ☐ Other-please specify ____

Q22. Experience with mobile learning (m-learning)

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I have the knowledge necessary to use m-learning	○	○	○	○	○
I would benefit from training on using m-learning	○	○	○	○	○
I would find m-learning easy to use	○	○	○	○	○
Learning using mobile devices is easy for me	○	○	○	○	○
A mobile device such as a Smartphone is an educational tool	○	○	○	○	○

I use m-learning services for exam time table and exam results	○	○	○	○	○

Q23. Using mobile devices for learning enables me to:

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Share ideas with my peers	○	○	○	○	○
Share ideas with my lecturers	○	○	○	○	○
Learn at my own pace	○	○	○	○	○
Learn when it is convenient for me to learn	○	○	○	○	○
Learn in a place that is comfortable for me	○	○	○	○	○

Use “free” time between other activities	○	○	○	○	○
Communicate more with my lecturers	○	○	○	○	○
Communicate more with my peers	○	○	○	○	○
Access more academic resources	○	○	○	○	○
Use a more flexible method of learning as it can be done anytime and anywhere	○	○	○	○	○
Have a quicker method of getting feedback in learning	○	○	○	○	○

Q24. Learning habits

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Using m-learning may increase plagiarism	○	○	○	○	○
With m-learning some students will not do their own work but depend on other students to do their academic work	○	○	○	○	○
M-learning will disadvantage those students who cannot afford expensive mobile devices	○	○	○	○	○
M-learning will make learning more fun and enjoyable	○	○	○	○	○
M-learning will lead me to explore the subject matter more	○	○	○	○	○
M-learning will bring new opportunities to learning	○	○	○	○	○

M-learning will make me engage more in my studies	○	○	○	○	○
M-learning will help me understand my study material more	○	○	○	○	○
M-learning should be incorporated with the traditional method of learning	○	○	○	○	○
I prefer the traditional method of learning where the instructor provides the information	○	○	○	○	○
If learning material is made available on mobile devices, I will use my device to access the material	○	○	○	○	○
M-learning can be used for mainstream education	○	○	○	○	○

Q25. When I am using my mobile device for studying:

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
If a message or notification comes through, I go to the message or notification	○	○	○	○	○
I tend to move to other applications that are not related to what I am studying	○	○	○	○	○
I just focus on my study material, until I am done studying	○	○	○	○	○
I find it is not effective and prefer not to use my mobile device for studying	○	○	○	○	○
I think mobile devices are for learning other skills (e.g. like cooking, how to	○	○	○	○	○

fix something) not academic stuff					
I forget the academic work I must do	○	○	○	○	○
I do not use my mobile device for studying	○	○	○	○	○

Q26. My learning style

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
When it comes to learning and studying, I am a self-directed person	○	○	○	○	○
In my studies, I am self-disciplined and find it easy to set aside reading and assignment time	○	○	○	○	○
In my studies, I set goals and have a high degree of initiative	○	○	○	○	○
I prefer to have someone monitor my academic progress by checking on me on a regular basis	○	○	○	○	○
I need help setting goals and often study when I see other people studying	○	○	○	○	○

X

Q27. Reasons why m-learning can be a challenge to implement

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
The unavailability of appropriate mobile phones among students	○	○	○	○	○
Poor Internet connectivity (i.e. low bandwidth or slow Internet connections)	○	○	○	○	○
Most students cannot afford to buy a mobile phone	○	○	○	○	○
Data bundles are too expensive for students	○	○	○	○	○
It takes too long to access online material from my institution	○	○	○	○	○

Some lecturers are not keen on m-learning	○	○	○	○	○
Unreliable electricity supplies	○	○	○	○	○
Too many messages or information send from the institution to my mobile device	○	○	○	○	○
Most students prefer using desktop computers for academic work	○	○	○	○	○
Mobile devices are not suitable for learning	○	○	○	○	○
There is no technical support for students when using mobile devices at my institution	○	○	○	○	○
My institution is not supportive of using mobile devices for teaching and learning	○	○	○	○	○

Q30. I would be willing to embrace m-learning for the following reasons or situations

	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
It is easier to communicate behind the screen, unlike face-to-face communication	○	○	○	○	○
I can fast-forward or rewind audio and video content	○	○	○	○	○
If there was a provision for cheaper data bundles for students	○	○	○	○	○
If I am provided with a suitable mobile device	○	○	○	○	○
I already use some form of m-learning informally and would like it done more formally	○	○	○	○	○

I am always on my mobile device and if learning material was available on it, that would mean I engage with my learning content more	○	○	○	○	○
I can collaborate with other students	○	○	○	○	○
If my peers were interested in it	○	○	○	○	○
If my lectures were keen on using it	○	○	○	○	○

Q31. Any other comments on m-learning you wish to add

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