# MOBILE EDUCATIONAL TECHNOLOGIES CURRENTLY USED AS A MEANS TO ENHANCE TEACHING AND LEARNING IN A PRIVILEGED HIGH SCHOOL

by

AGNES RAMAESELE HLAGALA

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I declare that **MOBILE EDUCATIONAL TECHNOLOGIES CURRENTLY USED AS A MEANS TO ENHANCE TEACHING AND LEARNING IN A PRIVILEGED HIGH SCHOOL** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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Author: Agnes Ramaesele Hlagala

University of South Africa

## ABSTRACT

Technology continues to progress due to the enormous growth of wireless technologies and mobile computing. Mobile devices such as handheld computers, smartphones and mobile phones are integrated into the daily lives of many people irrespective of their age, nationality or gender. These devices are embedded with computer functionalities and their ease of use and mobility functionality enable the people to use and move around with the mobile devices everywhere they go; the sophistication of these devices fascinates many learners thus they are fluent in using digital technology.

The aim of this thesis is to describe how these devices are being utilised for learning purposes using the qualitative data collection method, to use the FRAME model to evaluate the usefulness of mobile digital technology and to also understand the educator's role in the mobile age. This thesis explores the relationship between education (what is being taught), society (individual learners and their learning preferences) and technology (mobile tools used for learning), conceptualising the learner's perspective.

The research findings indicate that learners in the case study are enthusiastic about mobile educational technology, fluent in using digital technology and they prefer pen and paper for taking notes. The outcomes of this study suggest that although mobile technology has the potential to enhance teaching and learning, educators need to put more emphasis on providing technology-rich learning activities to empower high level of student involvement and take into consideration the learner's learning preferences towards learning using mobile technology.

**Keywords**: Collaboration, constructivist, content, mobility, mobile learning, mobile technology, perception, preference

## GLOSSARY

| | |
|---|---|
| 3G | Third generation of mobile telecommunications technology |
| Content | Learning activities facilitated by the teachers to the learners |
| Context | A physical setting where the learning activities takes place |
| Digital technology | Electronic technology using binary code to transfer messages between different machines quickening data transmission |
| GPRS | General Packet Radio Service enabling data transfers through cellular networks |
| GPS | Global Positioning System used to provide geographical location |
| GSM | Global System for Mobile communications used for transmitting mobile voice and data services |
| Mobile learning | Learning using mobile technology |
| SMS | Acronym for “short message service”, a communication medium used for sending or receiving short messages |
| Wi-Fi | Wireless local area network with high radio bands, this facility enables devices to connect to the internet |
| WWW | Acronym for “world-wide-web”, www is used for accessing information on the internet |

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# 1. INTRODUCTION

## 1.1 RESEARCH MOTIVATION AND BACKGROUND

The world we live in is dominated by technology where the majority of the people have access to digital technology and mobile devices are the emerging digital tools integrated into the daily lives of many learners. According to Prensky (2009) students born from 1980 are technology-savvy- they are surrounded by technology; they are familiar with digital tools such as video cams, computer games, digital music players and mobile phones. Today's mobile devices are more advanced than most of the 1990's personal computers and the focus is changing, shifting from using fixed computers to using handheld devices. Shapshak, cited by Brown (2003) reported that the implementation and adoption of mobile technologies in developing African countries is highly ranked globally, with an estimation of almost 100 million mobile subscribers.

Mobile tools are owned and used by everyone irrespective of their age, nationality or gender; they are embedded with computer functionalities and their ease of use, mobility and functionality enable the people to use and move around with the devices everywhere they go. The pricing models of the devices vary depending on the device capability, the supplier and the business logic behind the device; some devices are relatively expensive while others are inexpensive. Mobile devices are transforming the way in which we live, work and play. The sophistication of these devices fascinates almost all the learners thus learners are familiar with and fluent in using digital technologies (Prensky 2009).

But how are these devices utilized in education?

Mobile phone in Africa is one of the few technological tool widely used in both rural and urban setting to exchange knowledge (Ford and Batchelor 2007). The dominating tool is also used in the education sector for teaching and learning purposes (Johnson and Kritsonis 2007). According to Angeli and Valanides (2009) learners in the 21st century are obliged to adapt to new ways of learning, these learners are projected to be critical thinkers with the ability to solve problems through communication and collaboration using various technology. Hence they are referred to as 'citizens of information age'.

Digital technology has the potential and wide-ranging pedagogical affordances to transform the existing learning and teaching practices (Johnson and Kritsonis 2007).

The Gauteng province's Department of Education is planning to introduce mobile technologies widely in state schools; the Member of the Executive Council for education in Gauteng reported that they are in the process of transforming every state school into a textbook free zone; making learning available by digitalising all the curriculum content, to enable self-directed learning and to depend on electronic-books rather than paper copies of textbooks (City of Joburg.2015). The aim is to equip every learner with a mobile device that will be used for learning purpose and to enable learners to access online learning resources through the use of the internet. The scope and time schedule for this new commitment has not been announced, but the need for on-going research about transforming to paperless learning is clear. Research is needed to make sure that the education sector gets an evident return on investment from learning and teaching using digital technology and to support the effective combination of old and new learning activities.

In order to fully utilise the tremendous potential of mobile tools, it is important for the education sector to understand mobile learning from the learner's perspective and to understand how best to learn and teach using mobile tools. The aim of this study is to understand learning experiences, to study learners' preferences, perceptions and attitudes in order to provide recommendations on how future researchers can enhance those experiences beyond providing digital versions of text books. Individual learners' needs can best be accomodated by providing them with a variety of customisable content which matches their learning preferences.

The rationale for this study is that mobile technologies can be used to supplement classroom learning and conventional face-to-face teaching methodologies. According to Traxler (2007), mobile technologies such as handheld computers, smartphones and mobile phones make learning personal and portable. Naismith et al. (2004) argues that in order to enhance learning, computers in the classroom need to be mobile which means that it is essential to investigate the experiences and perceptions of learners utilizing mobile tools for learning purposes. This research is expected to benefit any

Education Department, researchers, teachers, policy makers and learners attempting to enhance or implement mobile tools for learning purposes.

This research will concentrate on digital educational technologies currently used in one privileged high school. This study defines a 'privileged school' as an English medium private school located in an urban area; the government has no control on the management of the school and the tuition fees are much higher than average schools.

Tatar, Roschelle, Vahey, and Penuel, (2003) recommends that researchers in mobile learning put more emphasis on identifying the key opportunities in mobile educational technologies, report on the unique attributes of learning using digital technology and strive to understand the social practices enabled by mobile devices. Thus, the aim of this project is to supplement the existing research on mobile educational technologies and to provide advice as to how educationalists can enhance the learner's learning experiences; to understand what mobile learning is, how it functions and to also understand why it might be useful to learn using digital technology. The reasons why mobile technologies and their use in education evolve rapidly will be explored in this study.

## 1.2 PROBLEM STATEMENT

The evolution of Information Technology (IT) has led us to this digital world we live in, where an increased number of people have access to mobile devices such as mobile phones, tablets and personal digital assistants (PDAs).

In 2003, the International Telecommunication Union (2013) estimates that the number of mobile cellular subscriptions was equal to 96% of the total population worldwide. The use of mobile phones globally has reached a remarkable level. However, the progress in the use of these essential devices for learning is slow when compared to social networking and communication (Quinn 2011). According to the study conducted by the Kaizer Family Foundation (2010) focusing on American youth, children between the age of eight and eighteen spend an average time of seven hours and thirty-eight minutes daily on media use. However, this finding indicates that technology use is mostly evident in the social media although it is also progressing in the education sector.

According to Psacharopoulos (1985) education is the main stimulant to economic success, the essential factor in improving economic growth, health, technological progression and political stability. Despite all the proposed positive characteristics of "learning on the go", some learners are reluctant to embrace the rapidly changing devices used for learning and indeed, not every learner enjoys learning using these tools. The reasons for this will be explored in this research project by exploring the experiences and perceptions of learners using mobile technologies for learning purposes attempting to understand the explanations of mobile learning. There is no question that mobile devices will in the foreseeable future still play an important role in the lives of South African citizens, thus it is important to conduct research about mobile learning to empower learners wherever and whenever they are to be effective. This project is not studying mobile learning because of the popularity of technology but because it is a potentially powerful capability that can be used to enhance learning.

## 1.3 RESEARCH OBJECTIVES

This research project will study mobile learning, attempting to understand how mobile learning is currently used in a privileged high school; learner's experiences and their perceptions about mobile learning will be studied in order to get a deeper insight into how learning using mobile tools supports the learner. The aim of this study is to understand the conveniences of learning using mobile tools; this study will also investigate the inconveniences of mobile tools as experienced by the learners.

This research project will explore the possible uses of the device and content that could be taught through digital technologies.

The research objectives are:

- To understand how digital technologies are currently being used in education and what content could be learned through digital technologies.
- To understand the individual characteristics affecting and influencing the learners, their lived experiences on utilising mobile tools for learning purposes and how their behaviours are influenced by their thoughts, feelings and principles. The study will

also explore the learner's preferred learning activities describing in detail their perceptions.

- To understand the educator's role in the mobile age, how the teachers support and motivate the learners using mobile tools.

The importance of this study is due to the potential of mobile tools to support learning. The focus of this project is to explore learner's perceptions and to describe their experiences in detail in order to recommend ways as to how mobile learning can be used to improve the standard of education.

## 1.4 RESEARCH QUESTIONS

Mobile devices are transforming the way in which we live, work and play but how are these devices changing the way in which we learn?

The main question for this research is: how can learning using mobile tools improve and compliment classroom-based learning? For this question to be answered, the following sub-research questions will be used:

- What educational content can be taught through mobile technologies?
- How do learners experience and engage with mobile devices for educational purposes?
- How are the teachers supporting learners in mobile learning?

## 1.5 RESEARCH SCOPE AND LIMITATIONS

The primary aim of this research is to support learning using mobile technologies and to engage with two teachers and fifteen learners in grade 11, where the learners are the primary benefactors of the technology and the teachers are the facilitators. The researcher recognises that this research project is of limited scale; this study was solely about voluntary participants of which two teachers and fifteen learners in grade eleven consented to participate. The goal is to conduct an in-depth research with interested participants in order to provide a greater sense of perspective rather than having false opinions from a large number of unwilling participants.

This study will focus on formal classroom learning in one advantaged secondary school, attempting to identify which mobile technology is being used for learning at that particular school. The reasons for selecting this privileged school will be described in Chapter 3. The aim of this study is neither to concentrate on the participant's socio-technological context, gender, race and ethnicity, nor to establish the link between mobile learning and learner's achievement however; the study will uncover ways in which mobile technologies can be used to improve learning. The study will also look at the output capabilities of the device, the critical challenges in the adoption of mobile learning; the challenges the learners face in utilizing digital technology for learning purposes.

The research methods used in this study include the Interpretivist paradigm, open ended face-to-face unstructured interviews to establish the participants' perceptions and experiences on the use of mobile technology in education through Qualitative analysis. Parents', the principal's and the government's perceptions are probably just as important but they will not be covered in this study.

The listed limitations indicate that the results of this research study should not be over-generalized, thus it is necessary to view the research outcomes in the context in which it took place.

## 1.6 CONCLUSION AND RESEARCH OUTLINE

This chapter has revealed the underlying principle of the study, describing the problem statement which guided this research, the relevant research questions that will be used to resolve the research problem; this chapter has also defined the scope and limitations of this study.

**Chapter 2** will firstly, review the existing body of published knowledge in the area of mobile educational technologies, identifying the gaps in the existing literature that require further investigation. Moreover, the chapter will be looking for the existing major and counter arguments relating to this study; focusing on the (1) uses and content that could be taught through mobile technologies, (2) the learner's perception and

experience on mobile learning and (3) the teacher's role in supporting and encouraging learners in the mobile age.

Secondly, this chapter will describe the theoretical framework that will be used for data analysis, describing in detail the importance of that particular framework.

**Chapter 3** will describe the technique of obtaining, systematizing and examining the data by outlining the research methodology, design and data collection methods selected for this research study, describing in detail the rationalisation underpinning the followed procedures and how that procedure will help in answering the research questions. The case study background will be described in this chapter.

**Chapter 4** will supplement chapter 3 by providing a thorough research background (context of the study) furthermore, the chapter will reveal and review the research findings and compare the findings with the literature reviewed in Chapter 2.

**Chapter 5** concludes this thesis by summarising the intention of this research project, this chapter will go into detail on how this study contributes to theory, practice and future research, moreover the chapter will explain the lessons learned during the course of this study, acknowledging the constraints of the study and listing the possible guidelines for future research.

# 2. LITERATURE REVIEW

## 2.1 INTRODUCTION

Some old philosophies of learning that have been advanced and projected make the assumption that learning only takes place in a classroom, facilitated by a teacher (Sharples, Taylor, and Vavoula, 2007). However, due to the enormous growth of wireless technologies and mobile computing, the concept of learning outside the classroom, "learning on the go" has emerged in some educational institutions and according to Brown (2003) mobile technology has the potential to make learning reachable and widely available anywhere, and anytime. The concept of learning on the go and having access to learning material wherever you go is slowly but surely becoming generally accepted. The transition to computers has changed our world tremendously, from using the first mechanical computer to 340K byte bubble memory laptops, and now "there's a computer in almost every child's hand" (Soloway et al. 2001).

But how are these handheld computers being utilized to advance learning?

According to eLearning Africa on the study conducted by Kasumuni (2011) mobile phones can enable both the learners and the teachers to listen to educational recorded audio or video content, share knowledge using SMS and to access a wide variety of information on the internet. The study further state that the sophistication of mobile phones can empower the learners to perform better academically and increase educational achievement among primary learners in learning science, mathematics and life skills. Margaryan, Littlejohn and Vojt (2011) state that learners lack understanding on how to fully utilize digital technologies to support their own learning hence they are reluctant to embrace mobile learning. This study however has focused on engineering students at university rather than secondary learners.

The aim of this thesis is to explore the relationship between education (what is being taught), society (individual learners and their learning preferences) and technology (mobile tools used for learning), conceptualising the learner's perspective.

As noted by Hart (2008), it is essential for every researcher, no matter what the field of study, to review the relevant literature prior to introducing any research. This enables the researcher to use the reviewed literature with confidence when advancing the existing body of knowledge or for creating new insights (Davison, Vreede and Briggs, 2005). A researcher is best positioned to perform significant research when the existing body of knowledge has been reviewed and understood correctly (Boote & Beile 2005).

This chapter will review the existing body of published knowledge in the area of mobile technologies in education. Mobile learning will be studied to understand how it is currently used; the study will review the potential uses of mobile technologies; the content that could be learned through mobile technologies; the literature will also review learners' perceptions about mobile learning in order to understand learners' experiences, challenges related to the implementation and adoption of emerging technologies in education will also be reviewed in this chapter and lastly the literature will review the educator's role in the mobile age.

According to Kirbey and Claussen (2006) there is still a great need for research into how the education sector can best use mobile technologies. Naismith et al. (2004) believe that there is a need to identify new and evolving practices concerning the use of mobile technologies for learning.

## 2.2 MOBILE EVOLUTION

### 2.2.1 What is mobile learning?

Mobile learning is the ability to learn and enjoy education using mobile tools (Paul 2001). Mobile learning is an emerging strategy which is progressing because of the enormous growth of wireless technologies and mobile computing. According to Kearney, Schuck, Burden, and Aubusson (2012) mobile learning has been minimally used in some education sectors hence there is a need to study the pedagogies that are suitable and can enhance learning, to conceptualise mobile learning from the learner's perspective rather than the affordances of mobile tools.

With regard to mobile learning, '*mobility'* means the ability to link classroom activities to the outside world, providing learners with the capability to learn in their own

environment (Naismith et al. 2004). Koole (2009) in her FRAME (Framework for the Rational Analysis of Mobile Education) model describes mobile learning as an on-going development which results from the use of mobile technologies, humans' ability to learn and their ability to socially interact for learning purposes. The concept of "learning on the go" has emerged as a common experience for many people and according to Brown (2003) mobile technology has the potential to increase productivity by making learning reachable and widely available anywhere and anytime. Mobile learning involves the opportunity to "learn on the go"; empowering the learner to have access to unlimited learning resources inside and outside the classroom. In addition, Joseph et al. (2007) notes that mobile learning provides learning that is freely independent of time and location; supporting collaborative learning experiences.

Many researchers (Looi 2010; Prensky 2009; Stockwell 2010; Waycott 2001) have researched mobile computing and investigated the assumption that mobile learning can be used to support learning, enabling anytime-anywhere learning. For example, Laurillard (2007) reported that computer simulations can be used to help students to enhance their learning. Winters et al. (2007) and Stockwell (2010) are in agreement that the value of mobile learning is reliant on the mobility *of the device*; therefore the focus of mobile learning should be on the device being used for learning.

However, Sharples et al. (2007) argue that the focus should be on the *mobility of learning*. "*By placing mobility of learning as the main focus we may better understand how to transfer knowledge and skills across all context*" (Sharples et al. 2007).

According to Seisto (2010) mobile learning is an extension of electronic learning as it is learning using portable mobile devices. Sife, Lwoga and Sanga (2007) define electronic learning as the use of ICT (Information Communication Technology) in education to support and enhance the processes of learning and teaching, they further note that electronic learning complements traditional teaching and extends the access of training material to a large audience.

There are common features between mobile learning and electronic learning, such as collaborative[1] learning and multimedia content (Cheon, Lee, Crooks and Song, 2012). However, mobile learning also has unique characteristics like the flexibility of being able to learn at any location and any time (Peters 2009). According to Brown (2003) mobile learning offers more convenience, flexibility and mobility than online learning.

Quinn (2011) considers mobile learning as learning facilitated through the use of Information Communication Technology (ICT); he further defines mobile learning as the intersection between mobile computing and electronic learning.

| | Face-to-face (f2f) learning | Mobile learning |
|---|---|---|
| Difference | This type of learning takes place in a fixed location usually in the classroom facilitated by the teacher; the teacher presents learning content to the learners. | This type of learning is not fixed to a dedicated environment. Learners and teachers can initiate learning activities and teachers support learners in the m-learning process. |
| Resources | Resources depend on paper material i.e. manuals, textbooks. | Resources depend on digital material i.e. electronic-books. |
| Learner's role | Learners are passive listeners, receiving knowledge. | Learners are active constructors of knowledge. |
| Roles | Teacher-centric. | Learner-centric. |
| Location and time | Restricted by time and the physical location. | Learning can place anytime, at any location. |

*Table 1: Conventional f2f learning vs. mobile learning (Adapted from Leh 2002)*

[1] Mobile collaborative learning occurs when two or more learners work together, and refers to the interaction between learners in education through the use of mobile devices (Cheon et al. 2012).

Table 1 shown above covers the difference between conventional face-to-face learning and mobile learning.

For the purpose of this research the definition provided by Kukulska-Hulme and Traxler (2005) will be used as the prime description of mobile learning. Mobile learning is a flexible way of learning, learning anytime, anywhere and accessing learning tools for educational purposes, to compliment teaching and learning (Kukulska-Hulme and Traxler, 2005). Moreover, this study consider mobile learning to be playful and enjoyable as defined by Paul (2001) "*mobile learning is the ability to learn and enjoy education using mobile tools*". Learners should learn the very same way they play, learning and play need to be relevant to their daily activities (Wenger 2010). Learning should be encouraged to occur in any location, whether in a classroom, at a place of leisure or at home (Naismith et al. 2004).

Traditional classroom learning tools include, but are not limited to: chalkboards, pencils, typewriters, writing pads and desktop computers. Learning tools that may be used in the 21st century classroom include a mobile phone, interactive white board, laptop computers with high speed internet connectivity, tablet computers and high-end graphics games with video and audio features (Christopher 2011).

How do learners learn using these advanced learning tools and for what purpose?

The section below will discuss the current state of mobile learning; focusing on the progression of mobile learning.

### 2.2.2 The current state of mobile learning

What used to be in a fixed location, a desktop computer, is now often a handheld device which gives users access to almost all the functionalities of a desktop computer. This evolution towards mobile computing started with a concept created by Alan Kay towards the end of 1968, when Kay wanted to create a lightweight computer for children specifically for educational purposes. The "Dynabook" was envisioned as an educational tool but due to technical difficulties the notebook was never developed. Nonetheless the concept led to what is currently known as a tablet personal computer.

According to Vernadakis et al. (2006) computers were first used in education as tools for teaching in the year 1950. Bitzer, regarded as the Father of PLATO (Programmed Logic for Automated Teaching Operations) was one of the first to realise the potential that graphics and sounds could bring to the learnng process. One of the many somewhat more recent researchers interested in this field, Waycott (2001), had an interest in mobile computing and carried out research about the effectiveness of using mobile computing devices to add value to learning; however his study focused on informal learning and the work context.

Many other authors such as O'Malley et al. (2003) have developed guiding principles for implementing mobile learning. The evolution of new technologies, such as GPS, GSM, GPRS, 3G, satellite systems, Wi-Fi and Bluetooth have led to the progress in mobile computing; mobile learning depends heavily on these advances in hardware and application developments. Mobile technologies that can be used for learning include mobile phones, preferably with internet access, laptops, tablets, personal computers and MP3 players (Martinez et al. 2010).

Development in information technology for education has been rapid and the use of technology in learning is widely acknowledged by scholars (Vernadakis et al. 2006). Computerization, also referred to as automation computing, is used extensively as a way of enhancing the educational process (Benitti 2012). The section below focuses on the current state of mobile application in the South African context.

Brown (2003) explicitly stated that the University of Pretoria is one among other South African institutions that implemented and adopted mobile phones in education during 2002 on three of their Faculty programmes, namely:

- Advanced Certificate in Education
- Education Management Law & Policy
- Special Needs Education

Mobile learning was introduced at this particular institution because 99.4% of the students enrolled for the above mentioned programmes had mobile phones. Mobile

texting functionality (SMS) was used to send administrative support reminder messages such as registration information, parcel tracking of the study material and exam dates.

The majority of these learners are from rural areas with poor technological infrastructure. The results of this pilot project indicate that:

1. South African learners are exposed to mobile technology.
2. Learners from rural setting can best be accommodated into schools that make use of emerging technologies.
3. Mobile learning can also be implemented in a rural setting.

According to the Nokia Mobile Learning project for Mathematics (MoMath) in the South African context on the article conducted by Roberts and Vanska (2011), learners worldwide make use of new electronic media such as the internet and mobile phones.

The goal of MoMath project in South Africa is to equip both the learners and the teachers with affordable access to interactive mathematics learning material among the grade 10 to grade12 pupils using mobile phones. This initiative was launched in the year 2009, enabling the learners to access a wide variety of mathematics questionnaire from the database classified by grade, topic names and the degree of complexity (easy, medium or difficult). Learners are able to answer the questions, the response delivery is immediate and learners can share their results with their peers, teachers and anyone from any location. MoMath service makes learning personal, collaborative and engaging - learners can read mathematics theory, test their understanding and collaborate or challenge other learners. Teachers can use MoMath to monitor the learner's skills level, enhance those experiences by recommending useful exercises and tests available on the MoMath services to individual learners.

The findings of this project indicate that learners who used MoMath frequently (completed more than 150 000 questions) improved in their studies and they developed a positive attitude towards mathematics than those who did not use MoMath service (Roberts and Vanska 2011).

The section below focuses on the opportunities offered by mobile technologies, reviewing the uses and content that can be taught through mobile technologies.

## 2.3 MOBILE OPPORTUNITIES AND CHALLENGES

### 2.3.1 Learning in the mobile age

Mobile technologies, such as mobile phones, smart phones, PDAs, tablet PC and laptops have become integrated into many of the daily activities of learners and are widely used to support learning (Sharples 2006). According to Naismith et al. (2004), mobile technologies are commonly used by children. Mobile technologies enable learners who might otherwise have been excluded to engage in education and offer learners a distinct learning experience. Prensky (2009) notes that "Today's students are no longer the people our educational system was designed to teach". He further state that the thinking and mental processing of these student's is profoundly different from their predecessors, they have developed new learning styles and intellectual capacities because of their exposure to technology. According to Van Rensburg (2002) effective learning occurs only when the learners are active participators in the learning process thus it is necessary to empower learners in the mobile age wherever and whenever they are to be effective. Learners are active participators when they know *how to learn* and *how to be independent* (Van Rensburg 2002).

Play is enjoyable, can occur anywhere and anytime, is often self-initiated and informal. According to Ke (2008) most learners distinguish gaming from learning, labelling games as fun and entertaining. As already mentioned, learners should ideally learn the very same way that they play; learning and play need to be relevant to their daily activities (Wenger 2010). If learners could learn at any location then the nature of learning would improve. According to Lee and Hammer (2011) games in education may improve and motivate learners to engage in the learning process. The intention of learning anywhere you choose (that is, mobile learning) is not to *replace* formal classroom learning but to *enhance* the classroom form of learning (Liaw et al. 2010).

### 2.3.2 Uses and content that can be taught through mobile technologies.

Mobile devices are embedded with several functions that can be used for learning. The word function is derived from the Latin word "*functio"*, meaning *"to perform*", and covers everything a computing device or product can do for a user. Some of the functions of mobile devices are only available on newer and more expensive mobile devices and have data cost implications. The section below will discuss some of the functions of mobile devices and the content that can be taught through mobile technologies.

Mobile digital technologies can be used to encourage learning in any location and learners can share learning resources among themselves (Laurillard 2007). Unlike formal classroom learning, mobile learning can reach a broad audience, that is any audience with a mobile device (Brown 2003). Mobile learning technologies support the distribution of learning material using a wide range[2] of multi-media content and they also support collaboration and personalized learning (Traxler 2007). Each of these will be discussed in the section below. Naismith et al. (2004), in their literature review, describe the wide range of activities that can be used to support learning.

Figure 1 summarizes how mobile technologies can be used for learning.

[2] There are different content forms of multi-media such as the combination of audio, text, video, animation, images or interactivity multimedia (Traxler, 2007).


*Figure 1: Uses of mobile devices for learning (Adapted from Naismith et al. 2004)*

### *Mobility*

According to Brown et al. (2015) there is a myth that mobile learning is "Learning while Mobile", this misperception is derived from the hypothesis that the term 'mobile' refers to 'mobility'. This section will clarify what *Mobility* is all about.

As mentioned earlier in this study, mobility in the mobile learning context refers to the ability to link classroom activities to the outside world, providing learners with the capability to learn in their ***own environment*** (Naismith et al. 2004)

Mobility offers the learner the opportunity to learn beyond the classroom as these devices can be taken from one location to another - they are personal and portable (Naismith et al. 2004). According to Koole (2009) the portability of the device is reliant

on its physical characteristics; the size and weight of the mobile device matters as much as the input and output capabilities of that device. Compared to desktop computers, portable devices can be used in any location suitable to the learner, instead of learning only in the computer lab or at a fixed location (Ching et al. 2009).

Some features such as GPS are specifically related to place and are closely related to mobility. Naismith et al. (2004) refers to this type of learning activity as ***situated learning***; learning that is not restricted by a physical setting. Mobile learning can take place whereas the learner is static in their ***own environment*** or physically ***on the move*** (Brown et al. 2015).

### *Access to information*

Mobile learning technologies enable learners to access a wide variety of information (Viberg & Grönlund 2013); learners can gather information and access research through search engines on the World Wide Web. Prensky (2009) notes that it is impossible for the human brain to remember everything and nowadays the common way to recollect in detail voluminous data is through digital technologies. Learners can save their learning material to disk or the cloud[3] storage and mobile technologies can enhance our access to any stored data (Schofield et al. 2011).

### *Collaboration*

Mobile devices enable people to communicate with each other and they are also capable of communicating and exchanging data with other communication devices. Smart phones are capable of accessing the internet but these features are not exclusive to mobile devices (desktop computers share most of the features). Mobile devices like "smart" phones can effortlessly connect with many other devices through Bluetooth connections and can identify the current location through GPS (Traxler, 2007). According to Ertl, Fischer, and Mandl (2006), video conferencing; also known as video

[3] Cloud storage is used to store digital data in logical pools, the cloud storage environment is managed and owned by the hosting (cloud storage service providers) company, the responsibility of the hosting company is to enable the enterprise and end users to store digital data, to run and protect the physical environment, and to ensure that the digital data is available and accessible.

teleconferencing - allows collaboration where participants can see each other and share artefacts through the use of telecommunication technologies. These technologies can be used for collaborative learning and for sharing learning content.

Mobile learning software supports learners when they collaborate with their fellow team mates, experts or anyone else, whenever they want to (Klopfer and Squire, 2008). Mobile technologies enable learners to share their experiences, ideas, and concerns with their friends, family or teachers; supporting a knowledge sharing environment (Looi, Seow and Zhang, 2010). Koole (2009) in her FRAME model describes social interaction as the individual learner's ability to grasp rules of cooperation in order to exchange and acquire more knowledge

Viberg and Grönlund (2013) in addition note that, it is important for learners to interact socially and to exchange ideas from a socio-cultural perspective. Mobile technologies offer collaborative and accessible learning experiences beyond the classroom (Joseph, Corbeil, and Valdes-corbeil, 2007). Communication can now be open and social through text messaging services, email and social networks.

According to Naismith et al. (2004), collaboration encourages social and constructivist learning where learners become active constructors of knowledge, supporting them when they communicate about their experiences and ideas.
Constructivism is a theoretical view based on the philosophy that meaning of the idea is routed by experience, influenced by the individual understanding, content, context and social environment (Savery & Duffy 1995).

MoMath service as already mentioned can be used to enable collaboration, allowing the learners to engage in the learning process and to share their learning experiences (Roberts and Vanska 2011).

### *Game-based learning*

As suggested earlier, people should learn in a way similar to play and game-based learning supports learning through play. Oblinger, Oblinger and Lippincott (2005) refers to students born in the 1980s and later as the "Net Generation" learners, characterising

them as the generation which likes to be linked to the internet, those who learn-by-doing (constructivist learners) and those who are fluent in playing computer games. According to Prensky (2009), 'Digital Natives' refers to learners who are fluent in using digital technologies and it is necessary for educators to accommodate such learners, to create new Digital Native methods of teaching all the subjects. Sharples (2006) states that it is essential for the educational system to take advantage of the technologies those children bring to the classroom in order to support learning.

Educational computer games are used in various fields, like medical education, military training, rehabilitation and language learning (Brom, Preuss, and Klement, 2011). According to a report on the use of computer games in education by Sparrowhawk (2002), educational computer games provide an opportunity to enhance learning using activities motivated by the content of computer games. McClarty et al. (2012) reports that digital games can facilitate learning because they are built on the philosophies of sound learning, providing skills as a result of playing the game stimulated by the learning content.

Gaming environments can provide the "Net Generation" with the flexibility to learn in the very same way that they play, learn by doing and to become self reliant (Annetta, Minogue, Holmes, and Cheng, 2009). This study further states that the use of computer games for educational purposes is rapidly gaining popularity - games can aid in learning difficult concepts and are adaptable to almost any language (Annetta et al. 2009). Learners may play educational games and this form of participatory learning can engage and motivate the learners (Schofield et al. 2011). According to Lee and Hammer (2011) educational computer games enable joyful learning experiences, allowing the learners to:

- Learn through active experimentation; games are embeded with complex rules and learners must discover and experiement with the game to figure out ways on solving the problem or executing the rules through play.
- Learn their own way; there are multiple ways to successfully complete the game therefore, learners are enabled to choose their own sub-goals in order to complete the game.

- Contol their emotions; games can trigger different emotions instigated by the success or failure of the game. Negative emotional experiences are in general caused by losing on the game. Games enable the learners to persist through negative emotional experiences and learners can play the game until they succeed. Learners as a result can learn that failure is an opportunity to learn.
- Collaborate; some games allows more than one players enabling the learners to socially engage in learning.

According to Ke (2008), computer-based mathematics games can positively improve the attitudes of students. The key objective of educational games such as Monkey Tales is to improve children's mental arithmetic skills; this 3D video game motivates children to participate in learning mathematics and can help increase their mental calculation speed more effectively than paper exercises (Núñez Castellar, Van Looy, Szmalec and de Marez, 2013).

Gee (2003) in his book '*What Video Games Have To Teach Us About Learning And Literacy'* presented thirty-six explanations as to why it is necessary to learn through video games to create an improved learning environments and to empower learners. He further reported that social play can be used to learn life skills.

Several researchers (Oblinger, Oblinger, and Lippincott 2005; Blackwell et al. 2014; Furió, González-Gancedo, Juan, Seguí and Costa 2013;Núñez, Van Looy, Szmalec, and de Marez 2013) have shown an interest in mobile learning games, and in their findings these researchers are in agreement that:

1. The majority of learners are attracted to computer games.
2. Educational computer games combine play and learning through participative methods.
3. Computer games may empower collaboration among learners (some games involve team effort).

According to Furió et al. (2013) play is an important activity when attempting to improve the nature of learning because what is pleasantly learned is most likely to be remembered and learners may have a better learning experience when learning using

their senses; learning by hearing, tasting, touching, seing and smelling objects. Prensky (2009) recommends that computer games be integrated into the curriculum because today's learners are born into a digital world and are confident in using digital technologies (Prensky 2009).

### *Digital storytelling*

A digital story is a story which is delivered as either audio, text or video through the use of technology; students sometimes create the digital stories, they do not always just watch or listen to TV (Christopher 2011). According to Malita and Martin (2010) digital story telling (DST) is a technology application with digital reading material aimed at conveying a message through story telling with the view to invoke the readers' emotions. For Robin (2008) DST is a tool that can enable learners to become imaginative when telling a story through identifying the topic, and writing a story about that topic using graphics and sounds so that the video or the sound clip can be saved, played or uploaded.

Story telling can contribute a great deal to the development of any child, be it for language expression, creativity or intellectual development (Fridin 2014).

Digital story telling can be used as an instructional method to help learners and teachers talk to one another about the story that is being told, enabling learners to develop media literacy (Christopher 2011). According to Brown et al. (2015) today's learners are more literate on digital media as compared to their educators; these learners are fluent and experienced in using mobile and social media.

Media literacy is the ability to evaluate, inspect and to create media through media technologies, these skills enable the learners to apply critical thinking skills by constructing new knowledge based on their own understanding using digital media (Brown et al. 2015).

Digital story telling enables learners to be in control in the learning process (Yang, Ya-Ting, 2012). Freedom of speech encourages learners to be motivated and confident

(Robin 2008). Listening and storytelling can shape the development of early learning and can also have an impact on the learner's intelligence (Yang, Ya-Ting, 2012).

### *Automatic text summarization*

Learners are encouraged to review all information relevant to their learning, however, auto summarizer is a tool that can be used to summarize large passages of text hence the section below discusses automatic text summarization.

Today's information age is growing at a rapid pace and, according to Gupta and Lehal (2010), it can be very demanding for any human being to summarize large amounts of data or condense large documents into a meaningful shortened version. The difficulty of finding relevant information and making sense of the data is becoming more important to most people (Sizov 2010). The goal of summarization techniques is to minimize the time and effort required for reviewing large text thus providing a shortened version (Yang, Chen et al. 2013).

Automatic text summarization can be categorized into two classes, extractive and abstraction ( Mani and Maybury 1999; Suanmali et al. 2009; Sizov 2010).

Abstraction text summary uses a language generation technique to examine and create a summary (Suanmali, Salim, and Binwahlan, 2009) while extractive summarization is the process of reducing a large text document with the aid of computer programs, omitting the redundancy and keeping the "most important" content (Gupta and Lehal, 2010).

Previous research on automated text summarization has focused on extractive summarization (Yang, Chen et al. 2013). Yang et al. (2013), when exploring the effectiveness of automatic summarization in mobile learning contexts concluded that in a mobile learning environment, using a device with a small screen, long pieces of text are difficult to read and to follow, hence auto summarisation is of particular interest in m-Learning, as it is essential for the readers to comprehend, shorten, assess and regularly transform the summarized text. The study further identifies effective ways of evaluating the summarized text. However, according to Yang, Chen, Sutinen, Anderson, and Wen

(2013) reducing large text into summarized text may negatively impact the importance of the conveyed content.

### *Computer-assisted instruction*

Computer-assisted instruction is computer software that is used to carry out instructional activities primarily for teaching purposes (Owusu, Monney, Appiah, and Wilmot, 2010). Pilli and Aksu (2013) note that students can achieve many of their educational goals when computer-assisted instruction is used to support the traditional form of learning. Though computer-assisted instruction programs may be easily accessible by learners, the program should not be used as a complete replacement for any other printed reading material and the writing board (Vernadakis et al. 2006). Using computers in the classroom will definitely not resolve all the problems currently faced, but computer-assisted instruction can act as an additional tutor to the learners, assisting the teachers with numerous functions of instruction (Owusu et al. 2010).

Pilli and Aksu (2013) further states that computer-assisted instruction can offer learners an active and a practical learning experience, that is, encourage constructive learning. Learners can put the theories they are learning into practice, making learning more relevant. Several researchers (Owusu et al., 2010; Picciano, Seaman, and Allen, 2010; Pilli and Aksu, 2013; Vernadakis et al., 2006) report on the advantages of computer-assisted instruction, such as self-directed learning and self-paced learning, allowing learners to learn in their own pace.

According to Gu et al. (2010) computer-assisted instruction offers the benefit of **personalized learning**, being able to customize the learning material to the specific requirements of every student. For example, if a learner wants to repeat a task he/she can do so at anytime and as many times as he wants to. According to Brown et al. (2015) mobile environments in the future will offer increased opportunities for contextual and personalised learning.

With self-directed learning, learners can choose their own content or topics they want to cover and they can learn in any order that suits them, anytime and any place. Moreover, Owusu et al. (2010) report that computer-assisted instruction has the

potential to enhance the performance for senior high school students who have previously performed at a lower standard or level than expected. Studying the effects of computer-assisted instruction on fourth grade mathematics, Pilli and Aksu (2013) revealed in their findings that computer-assisted instruction helped learners to develop a positive attitude and to better understand fractions because of the immediate interactive response.

*Personalization*

Hsu, Hwang and Chang (2013) emphasized in their study that the "one-size-fits-all" learning method will restrict learners from performing optimally. Mobile learning gives an opportunity to customize learning activities based on individual learning styles and preferences (Viberg and Grönlund, 2013). According to Traxler (2007) personalized learning embraces diversity, recognizes physical differences, social cognitive differences and individuality in ways that support learning and learners.

### 2.3.3 Challenges related to the implementation and adoption of emerging technologies in education

A range of explorative studies regarding the use of technology in education have been published by various researchers in recent years. In Tanzania, Lwoga (2012) conducted an exploratory survey where six personnel from public ICT universities were interviewed. The study examined the adoption of web 2.0 technologies and electronic learning for higher institutions attempting to evaluate the usefulness and utilisation of innovative technologies to support teaching and learning. The findings showed that university individuals were more enthusiastic and involved in using e-learning than management. Several challenges were faced by surveyed universities when implementing the activities of e-learning.

The following are some of the challenges the surveyed universities faced:

- Affordability: the pricing models of educational technologies is relatively expensive, due to financial constraints some learners were unable to sustain internet connectivity cost.

- Poor infrastructure: the wireless technology infrastructure is in low Internet bandwidth therefore, learners were limited from attaining resource-rich learning content such as video streaming, video clips and downloading or uploading large files.
- Lack of technical support: there is lack of local Information Communication Technology technical expertise to support electronic learning initiatives.

In a recent study Jantjies and Joy (2015) report that South Africa is a multilingual and a diverse country whereby the majority of the learners are not taught in their first language, as a result teachers and learners sometimes have difficulties in interpreting and understanding the learning content hence they converse between languages (code-switching). The study evaluates M-Thuto (Mobile Education) through a case study.

M-Thuto is the mobile learning tool developed to support mathematics bilingual learning in South Africa. This web-based application consists of the learning material, interactive class activities with recommended solutions to enhance and support the learners' understanding. This tool uses code-switching technique between Setswana and English language to deliver the learning content; and can be accessed on any mobile phone that has a Wireless Application Protocol (Jantjies and Joy 2015).

The study indicated that 67% of the learners in the rural area struggle to understand the learning content whereas 42% of the learners in the urban area struggle to understand the learning content. The findings also indicated that the majority of the learners from the four participating schools either owned a mobile phone or had access to a mobile phone at home. The study illustrated that rural and township schools have limited learning resource whereas schools located in the urban area are well resourced. All 90 learners believe that mobile learning resources would effectively support them in the learning process and using their first language (Setswana) in the learning process enables them to clearly understand mathematics learning tasks.

M-Thuto was able to provide the participants with the ubiquitous multilingual learning material.

## 2.4 MOBILE EXPERIENCE IN LEARNING

### 2.4.1 Background

At eLearning Africa 'Scaling Up Business Education' session Cook, the Faculty member of the University of Pretoria concluded without elaborating further that "If learning leads to behavioural change, then there is a practical reason that education should be viewed from the behavioural point of view" (Bodie 2015). The study conducted by Komarraju, Karau, Schmeck and Avdic (2011) indicates that individual personality can play an important role in influencing the learner's academic performance and achievement. Extensive prior studies (Kim, Rueckert, Kim, and Seo, 2013; Kim, 2012; Komarraju, Karau, Schmeck, and Avdic, 2011; Leong, 2011) have reported various individual characteristics that can affect and influence learners' experiences, and how a person's behaviour can be influenced by thoughts, feelings and principles.

Self-efficacy can be the basis for motivation, confidence and personal satisfaction (Bandura, Barbaranelli, Caprara, and Pastorelli, 2008). Self-efficacy is self-belief about one's proficiency to reach or complete a goal (the power of self-confidence, believing you can do it yourself). Self-efficacy beliefs can control people's influence on themselves, their behaviour, their thinking and their feelings; people with high self-esteem think of themselves as 'winners', they are interested in all the tasks and they have the ability to solve complex and straightforward challenges. A high sense of self-efficacy enhances human achievement in several ways, whereas people with low self-efficacy have self-doubt, low aspiration and do not believe they can accomplish complex challenges (Bandura et al. 2008).

Some studies have found that learners who are interested in what they are doing are most likely to improve in their studies and to experience a positive learning experience (Leong 2011). Leong's study further concludes that interest will influence learning and consequently learners' attitude towards learning. In addition, Traxler (2007) notes that the use of mobile devices may increase a learner's participation in education, when learners are intrigued their level of engagement rises and this makes them more interested in learning.

The use of mobile technologies in education is increasingly attracting a different audience, enabling innovative contexts of learning (Viberg and Grönlund, 2013) and the current dominating development in education is mobile learning (Wu et al. 2012). According to Viberg and Grönlund (2013) there is no hesitation in saying that the use of mobile technologies for enhancing learning will be adopted in education in the very same way that these technologies have been embedded in people's daily lives.

### 2.4.2 Learners' experience and perceptions of mobile technologies in learning

Naismith et al. (2004) argues that in order to enhance learning, computers in the classroom need to be mobile. However, what are the perceptions of learners about using mobile devices for learning? Learners are important contributors in the mobile learning environment, hence, according to Bourgonjon et al. (2010), it is essential to investigate the experiences and perceptions of learners currently using mobile tools for learning; to enhance education and to create effective learning models. Learners' perceptions should be considered systematically (Kim, 2012). According to Feldman et al. (2014) it is important for the educationist to understand the learners' learning styles, their perceptions and attitudes in order to enhance their learning experiences by providing them with the learning content suitable to their style.

Learners' experiences and perceptions about mobile learning are reviewed in the table below in order to get a deeper insight on how learning using mobile tools affect and supports the learner.

The sample of papers shown below (Table 2) were selected from the Computers and Education journal.

| Author (year) | Purpose | Learners' perceptions and experience |
|---|---|---|
| Bourgonjon et al. (2010) | Studying students' acceptance of video games for learning in the classroom.<br>(Learning through video games) | The results of the study reported that not all learners are interested in learning through the use of video games, as there were a substantial number of learners who reported that they never played video games in their lives and those learners were reluctant to embrace video games as a learning tool.<br>Learners are familiar with computers and video games were excited and accepted learning through the use of video games in the classroom. |
| López-Pérez et al. (2011) | Assessing learners' perceptions and their relationship with outcomes.<br>(Blended learning) | The results obtained from this study revealed that the combination of face-to-face classroom learning and electronic learning has a positive effect in enhancing learners' pass rate and minimizing the dropout rate. Learners in the case study had positive attitudes towards blended learning; learners were more engaged in the learning process and the interaction between the instructor and the learners improved.<br>Learners reported that the online activities greatly helped them to control the subjective and objective achievements for learning. |

| Author (year) | Purpose | Learners' perceptions and experience |
|---|---|---|
| Fernández-López et al. (2012) | Supporting learners with special education needs through the use of iOS.<br>(Using iPad and iPod touch devices for learning basic skills) | According to Fernández-López et al. (2012) learners with disabilities have special education needs as they encounter difficulties in learning, they learn in a different way as compared to learners without disabilities thus they require special education attention.<br>The experimental study was performed using Picaa (interactive and cooperative platform to support learning) by 39 participants with impairments and the results showed positive outcomes as learners improved in their language, autonomy, social and environmental skills. Learners were entertained and they reported that they are happy that the activities were personalized. |
| Sung and Mayer (2012) | Assessing the beliefs of learners in South Korea and the United States.<br>(Mobile devices Vs. desktop computers) | The results of the study showed that both sets of learners were attracted to using mobile devices because they are seen as accessible and light weight whereas desktop computers are static.<br>However, USA learners had positive beliefs about desktop computers (learners believed desktop computers are more efficient) rating them higher than mobile devices while South Korean learners viewed both learning media as being equivalent. |

| Author (year) | Purpose | Learners' perceptions and experience |
|---|---|---|
| Yang and Wu (2012) | Exploring the impact of digital storytelling.<br>(Learning English as a foreign language) | The experimental results of the study indicate that after digital storytelling was introduced for a period of 20 weeks for senior high school learners, learners improved tremendously in learning English interpretation, listening and writing skills. Learners reported that "it is interesting recording English narration".<br>Moreover, learners were motivated as they were alerted to the fact that it is possible for their stories to be viewed by an online audience hence they were motivated to work to the best of their ability. |
| Martin and Ertzberger (2013) | Investigate the effects of here and now mobile learning on student achievement and attitude.<br>(Learning art content) | The study compared the results of learners learning art using iPad compared to learners using desktop computers.<br>The computer-based learners outperformed the iPad group although the iPad group was highly motivated and enthusiastic about the mobile technology yet they scored lower exam marks. The study reported that, based on observations and learner's attitude, iPad learners were more distracted and were paying less attention to their lessons when compared with the computer-based group. The computer-based group achieved better results whereas the attitude score favoured the iPad group. |

| Author (year) | Purpose | Learners' perceptions and experience |
|---|---|---|
| Viberg and Grönlund (2013) | Examining learner's attitudes to the use of mobile technology in education.<br>(Foreign language learning) | Individualization: 83% of the participants in the case study were positive because of the customization of activities based on the learner's preference.<br>Collaboration: 74% agreeing that they can engage in collaborative learning, communicating and sharing learning content with peers, teachers and anyone from any location.<br>Authenticity: 73% were positive, enticed by the opportunity of accessing realistic tasks through mobile learning and they appreciate that a mobile tool gives them an opportunity to do community practice in their language learning. |
| Lam et al. (2013) | Investigating learners' disciplinary differences and the perceived usefulness of eLearning.<br>(eLearning perceptions) | Learners in the case study all had positive views about using mobile technology for both teaching and learning.<br>Learners were confident using eLearning during a collaborative study with their peers. Students changed from being inactive to being engaged.<br>Learners felt that electronic learning allowed them to easily access information. |

| Author (year) | Purpose | Learners' perceptions and experience |
|---|---|---|
| Feldman et al. (2014) | To build a learner's profile from a puzzle game<br><br>(Playing educational puzzle games) | Learners were requested to select any of the 10 online published games to detect their preferred learning style.<br><br>26% were intuitive learners: intuitive learners dislike repetition, welcome complexities and are fluent in computer games.<br><br>36% were neutral learners: they played few games; based on observation, the study revealed that neutral learners failed to complete the puzzle and lost interest in exploring other games.<br><br>38% were sensitive learners: sensors like resolving easy problems dislike surprises and are slow in computer games. |

*Table 2: Learners' perceptions (Adapted from Computers and Education)*

## 2.5 THE EDUCATOR'S ROLE IN THE DIGITAL AGE

The term educator refers to any person who teaches, educate or facilitate the learning process at any educational institution.

At eLearning Africa 'Scaling Up Business Education' session Bamkole, cited by Bodie (2015) points out that it is not possible to cater for today's learners using traditional practices, these learners are advanced, they require immediate results and they are the problem solvers thus the teacher's role is to manage the use of technology and conduct networked learners. Solvberg and Rismark (2012) emphasise that educators in higher education are faced with the challenge of implementing mobile digital technologies in ways that fully supports every learner. Teachers have a responsibility to equip learners with the skills and knowledge to meet future challenges; these skills include problem

solving, self-corrective thinking, communication skills and collaboration skills. According to Laurillard (2007), teachers are responsible for designing improved methods of learning for their learners. The main issue for teachers in the education sector is not whether to integrate technology in their curriculum but how to get the most out of technology to enhance the existing teaching practices (Angeli and Valanides, 2009). Educators need to recognise the individual learning preferences and styles, thereby they can enrich the academic curriculum by taking into consideration each learner's abilities and strength when implementing mobile technology in the learning process (Van Rensburg 2002).

Ching, Shuler, Lewis, and Levine (2009) states that, it is important for learners to improve in English, Mathematics and other subjects. They report that educators can use mobile technologies in the learning environment to encourage learners to create their own content and encourage teamwork among peers. Without stating definite reasons, they further report that educators either love or hate mobile technologies in education and in their classrooms. Their study also states that mobile technologies can help in developing numerous skills such as media literacy skills and can help in advancing digital equity.

There's no doubt that the learning environment can be or has the potential to be transformed by the integration of ICT in education; however this new digital form of learning requires a shift in focus from traditional face-to-face learning to mobile learning (Bucklow and Clark 2003). Furthermore, Prensky (2009) notes that educators need to reconsider their teaching styles and content when educating digital natives, as they are familiar and fluent in using digital technologies whereas the teachers are often less frequent users of these technologies. He further states that today's educators have to fine-tune their language to those of their learners. According to Wilson (2003), educators need to focus on how to integrate technology into their curriculum and study the educational use of technology.

Pellegrino and Hilton (2012) mention that the desires of the internet generation need to be taken into consideration in education. It is essential for educators to develop their own ICT skills, their capability to teach and to control ICT use in the classroom (Lao,

2000; Sime and Priestley, 2005; Szuba et al., 2005). As explained by Wang et al. (2009) learners are the main participants interacting with the mobile tools and the teachers have the responsibility to motivate and assist the learners. Anderson (2004) supports that point of view by stating that it is important for the teacher to be present to monitor and guide the learners when needed.

For mobile learning to be successfully implemented, learners and teachers must be open to new ways of teaching and learning. According to Brown (2003) the subset of flexible learning is divided into two types of learning, such as:

- **Contact learning** refers to residential or traditional face-to-face learning, this type of learning usually takes place in a static environment.
- **Distance learning** is divided into two subsets: electronic learning and paper-based learning. Electronic learning is the key concept that includes online learning and mobile learning environments - learning through the use of online learning content. Paper-based learning is the traditional method of learning – learning through the use of paper-based learning material. Online learning takes place in wired networked environments whereas mobile learning takes place in wireless stand-alone environments.

Figure 2 covers will cover the subset of flexible learning as described by Brown (2003).

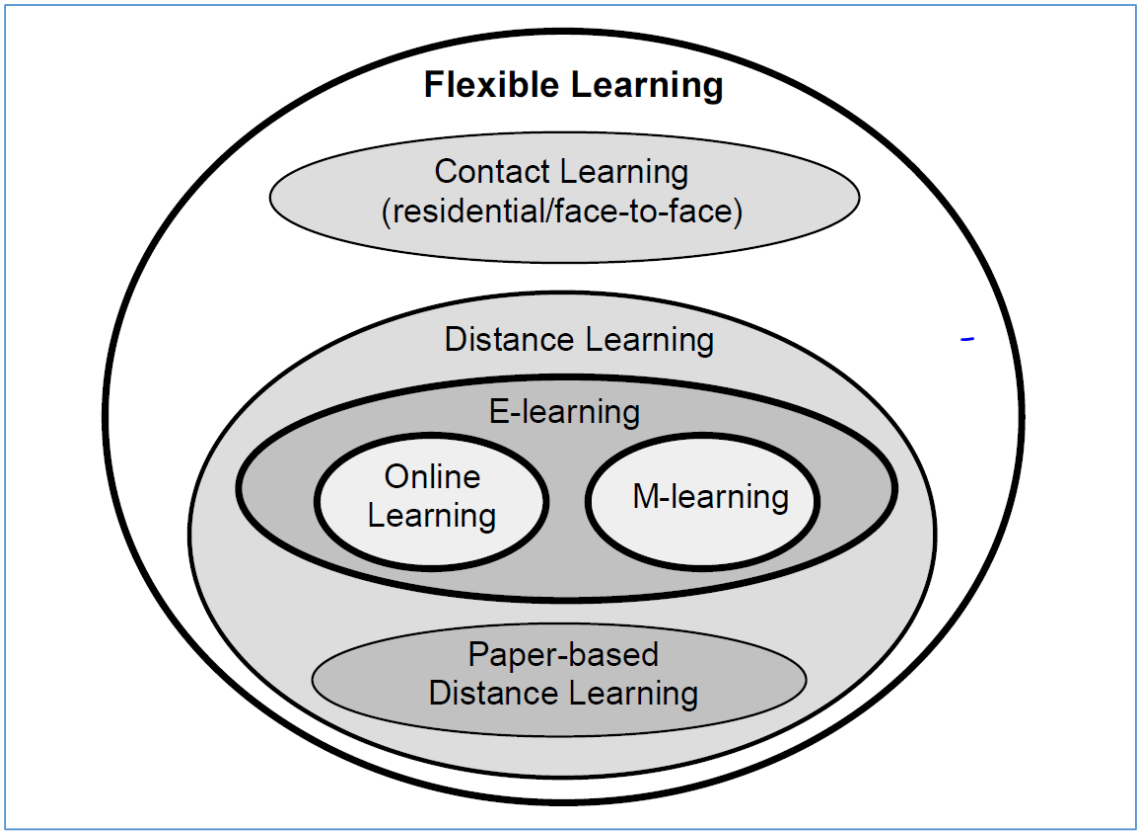


*Figure 2: The subset of flexible learning (Brown, 2003)*

According to Soloway et al. (2001) learners should be supported in their use of their choice of technology where that it is appropriate for learning.

"I have confidence that now is the time to fully embrace the enhancements of digital technology, to become digitally wiser and to encourage others to do so" (Prensky 2009).

## 2.6 THEORETICAL FRAMEWORK

Several researchers (Kaptelinin and Nardi, 2006; Laurillard, 2007; Koole, 2009; Park, 2011) have sought to evaluate mobile learning. As described already in the definition section, mobile learning supports learning through the use of technology. According to Ennis (1999) a theoretical framework points the researcher to established knowledge directed by a theory; a framework incorporates the main variables influencing the phenomenon studied and highlights the requirements needed to examine those variables. She further states that a theoretical framework is the focal point of the

research puzzle and it is important for every researcher to bring together a theoretical framework and to review the relevant literature in order to solve the research puzzle. Maxwell (2005) defines a theoretical framework as the “idea context”- the key part of the research design; it explains the main concepts to be studied and the acknowledged relationship among those factors.

Jabareen (2009) describes the features of conceptual frameworks as follows:

- They provide an understanding and interpretive methodology to the social truth.
- They can be established through qualitative examination.
- A conceptual framework is not just a collection of ideas, but a theory in which each concept plays a vital character in the study.

### *The FRAME model*

The FRAME model was at first developed as the foundation for evaluating the suitability of mobile devices and usefulness of mobile technologies for distance learning. The model is one of the first theoretical model to define mobile learning as a learning process through the combination of mobile aspect, learner aspect and social aspect (Koole and Ally, 2006). The FRAME model describes the effective ways in which mobile devices can be used to support informal and formal learning contexts.

Koole (2009) in her FRAME model draws attention to the advantages of using mobile tools in education. In addition, the FRAME model offers insights on how to benefit completely from the mobile experience and how to implement mobile learning in both formal and informal settings, taking into consideration the social, practical and individual aspects of learning. The FRAME model describes the socio-cultural outlooks of learning including the technical, personal and social characteristics of learning (Koole 2009).

Figure 3 covers the aspects of the FRAME model using a Venn diagram where the three aspects (device, learner and social) overlap with three intersections (context learning, social computing and interaction learning).

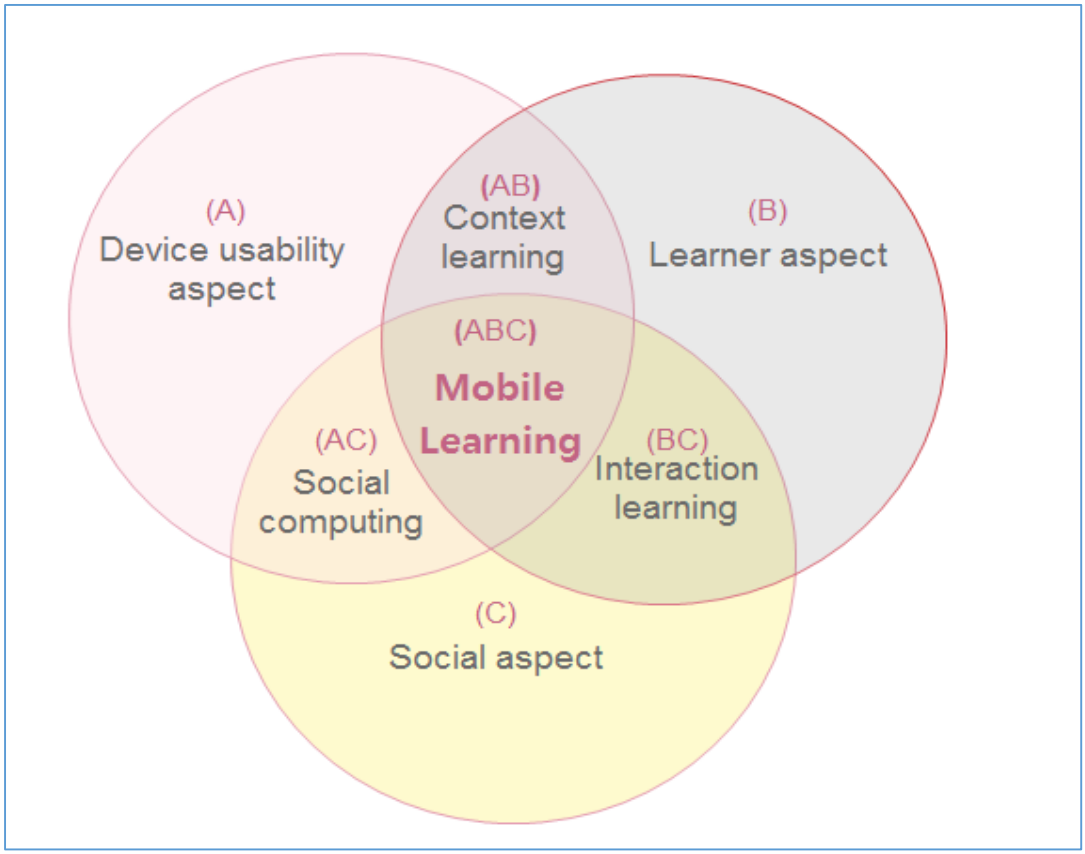


*Figure 3: The FRAME model (Koole and Ally, 2006)*

According to Kaptelinin and Nardi (2006), activity theory can be used to evaluate learning as a cultural historical development facilitated by technological tools to enhance and support learners to acquire information and skills in education. Activity theory, however, does not conceptualize the connection between the learner and the tool used for learning within a facilitated activity. The concepts used on the FRAME model are similar to those found in the Activity Theory (Kaptelinin and Nardi, 2006), however the FRAME model puts emphasis on the aspect of technology and on the concept of learning by doing (constructivism) where the learners have the flexibility to learn in any location and to socially interact with other people. Table 3 covers the aspects of the FRAME model.

| Aspects | Characteristics |
|---|---|
| Device usability aspect (A) | Describes the unique characteristics of the mobile device such as:<br>– The physical characteristics (the size and weight of the mobile device)<br>– Input capabilities (touch screen, mouse, voice recognition and light pen etc.)<br>– Output capabilities (any visual and auditory output mechanism such as the monitor and screen etc.) |
| Learner aspect (B) | Describes characteristics of the learner, such as his or her background knowledge, the learning style, feelings, experience and perceptions towards accomplishing any tasks in mobile learning and the capability to transfer knowledge and skills across all contexts. Educators and teachers also play a vital role in supporting and motivating the learners. |
| Social aspect (C) | Describes the social interaction among individual learners, and the learners' ability to grasp rules of cooperation in order to exchange and acquire more knowledge through interaction. The social aspect also takes into consideration the cultural (virtual or physical) ethics. |
| Context learning (AB) | Contains the elements that belong to both (A) and (B). The intersection describes the learner's requirements and content in relation to the mobile device. Portable mobile devices as described in the '*Mobility*' section enable the learners to move around to any location suitable for learning purposes. |

| Aspects | Characteristics |
|---|---|
| Social computing (AC) | Contains the elements that belong to both (A) and (C). The intersection describes the learner's ability to socially interact with community members to gain relevant information or access to other networked systems at an appropriate time. |
| Interaction learning (BC) | Contains the elements that belong to both (B) and (C).<br>The intersection is influenced heavily by various social constructivism philosophies. |
| Mobile learning process (ABC) | According to the FRAME model, effective mobile learning results from the intersection of (A), (B) and (C). The mobile learning process offers enhanced social collaborative learning among learners and a deeper information context for learning. The major aim is to enable ABC by taking all the aspects into consideration when planning to implement mobile learning in both formal and informal settings. |

*Table 3: The FRAME model ingredients (Adapted from Koole 2009)*

## 2.7 CONCLUSION

This chapter presented the possible uses and content that can be taught through mobile technologies, attempting to understand the current uses of mobile technologies and describes in detail some of the functionalities of mobile devices.

The study also reviewed learners' experience and perceptions of mobile technologies in learning, reviewing the critical challenges relating to the adoption of mobile technologies in education. Additionally, the educators' role in the mobile age was discussed. In order to enhance the learning experience and to provide content suitable to their style, it is important to understand how mobile technologies affect the learner's learning experiences.

The next chapter will describe the technique of obtaining, systematizing and examining the data by outlining the research methodology, design and data collection methods selected for this research study, describing in detail the rationalisation underpinning the followed procedures and how the followed procedure will help in answering the research questions. The context of the study will be described in that chapter.

# 3. RESEARCH DESIGN AND METHODOLOGY

## 3.1 INTRODUCTION

All research is established on a personal philosophy and assumptions about what is deemed valid, thus it is important to understand the fundamental philosophical assumptions of any research. The meaning that the individual researcher attaches to a research is influenced primarily by the researcher's approach and methodologies (Kothari 2012). According to Williams (2007), research is a methodical enquiry or investigation whereby the researcher gathers data and examines the data attempting to interpret, describe and predict the phenomenon studied. Research is triggered by at least one question if not many about a phenomenon interesting the researcher (Williams 2007). According to Yin (2009), research design is the logical structure which links the observed facts to the research questions and most importantly to the outcomes of the research. According to Kothari (2012) the objective of any research is to determine the answers to the research questions through systematic investigation.

A research question is a question that the researcher strives to answer, is embodied explicitly or implicitly within the research problem and is derived from the research problem. Research questions help the researcher to accomplish a goal or aspect, focus thoughts and to select the suitable methodology.

As stated in Chapter 1, the aim of this research project is to complement the current knowledge of mobile tools in education by looking at current practice in one particular environment and the objective of this study is to understand how mobile learning is currently used in education and to evaluate learner's experiences and perceptions about mobile learning in order to get a deeper insight on how learning using mobile tools supports the learner. The table shown below (Table 4) covers the research questions and goals that guide this research project.

| Research question | Goal / aspect |
|---|---|
| 1. What educational content can be taught through mobile technologies? | To understand how mobile educational technologies are currently being used and what content could be learned through mobile technologies. |
| 2. How do learners in the case study experience and perceive mobile devices for learning? | To understand the physical characteristics affecting and influencing the learners in mobile learning, their preferences, their lived experience on using mobile tools for learning and how their behaviours are influenced by their thoughts, feelings and principles. |
| 3. How are teachers supporting learners in mobile learning? | To understand the educator's role in the mobile age. |

*Table 4: Questions and goals that guided this research project*

## 3.2 RESEARCH PARADIGM

Knowledge and the interpretation of the study are influenced by a theoretical framework or paradigm. The word 'paradigm' is derived from the Greek word "*paradeigma*", meaning "*pattern*". According to Mackenzie and Knipe (2006) a paradigm is "an established assumption about how things work". Weaver and Olson (2006) define paradigms as practices and beliefs used to guide and control the investigation within a certain regulation by providing frames, processes and lenses that can be used to accomplish the investigation.

According to Mackenzie and Knipe (2006), it is necessary to select a paradigm as the first step when conducting a research in order to have the basis for subsequent selections concerning the research design, literature and methodology. The section below will discuss three research paradigms namely; the positivist paradigm, the interpretivist paradigm and the critical paradigm.

### 3.2.1 Positivist paradigm

The positivist paradigm is often referred to as scientific research, whereby the intention of the researcher is to thoroughly describe an experience or test a theory; positivist researchers often look for causal relationships and rules so as to be able to predict future events or results (Biggam 2008). Positivists work on the assumption that the social world operates the same way as the natural world, hence they see research as being objective, value free and the results as being unaffected by the researcher and thus replicable by other researchers. This leads to the goal of generalising from results.

According to Biggam (2008) positivist research is commonly used by mathematicians and scientists and is less dominant in the humanities research studies. Positivists generally begin their research with a hypothesis or series of hypotheses. They then build a model which may confirm an existing theory or may create a new one.

### 3.2.2 Interpretivist paradigm

The use of interpretive research in the information systems research has been widely used in recent years (Klein and Myers, 1999). According to Mackenzie and Knipe (2006) the interpretivist paradigm is sometimes referred to as the constructivist paradigm, whereby the researcher aims at understanding the human experience. Klein and Myers (1999) further state that interpretive research in information systems research is often used to confirm a theory and can be used to help information system researchers to better understand the human actions and thoughts in the social community. As noted by Walsham (2006) an interpretive research study begins with the notion that knowledge is a social structure, constructed by using human social skills.

According to Creswell (2013), human beings make sense of and engage with the world based on social and historical perspectives; hence interpretative researchers seek to personally understand the perspectives of the participants in a given context.

In contrast with positivist research, interpretive research proposes that interpretations differ according to who makes them; they are subjective not objective. The approach adopted by interpretative research is not based on pre-defined hypotheses. The interpretative method aims at investigating core reasons influencing decision making

and focuses on smaller samples rather than large samples. Patton (2002) supports the interpretative concept, namely that the “instrument is the researcher”. The perceptions and experience of the participants in the research will all differ and will reflect multiple perspectives depending on how they interpret a specified phenomenon. Far less generalisation can be done using interpretative research.

The Interpretivist paradigm will be used in this study, attempting to understand learners’ experience and perceptions of mobile technologies in learning. According to Feldman et al. (2014), it is important for the researchers to understand the learners’ perceptions and attitudes in order to enhance their learning experiences by providing them with learning content which is suitable to their learning preferences. The interpretivist researcher works mainly on the views, background and experiences of participants; they do not in general begin with a theory rather they produce a pattern of meaning throughout their research study.

The interpretive paradigm is related to methodological approaches that provide research participants with an opportunity to voice their perceptions (Cole 2006). For this reason, this model will enable the researcher to understand the participants’ perceptions and experiences on the use of mobile tools in education.

### 3.2.3 Critical paradigm

The word ‘critical’ in information systems research is used in a wide variety of approaches such as critical theory, critical management studies, the critical perspective and critical operational research (Howcroft and Trauth, 2004). According to Mingers et al. (2013) critical research aims at comprehending and enhancing the human potential on the assumption that people can deliberately change their economic and social conditions, nonetheless they are aware that their ability to enhance their conditions is controlled by various forms of political, cultural and social domination.

According to Cecez-Kecmanovic (2011) there is no unique methodological identity for critical research in information systems while research paradigms such as positivist research are often associated with surveys and experiments, and the interpretivist

research paradigm is regularly related with the ethnography, field study and action research.

Critical Postmodernism researchers believe that social reality is factually established and their research interpretation is not an end in itself but rather an introduction for a transformative achievement (Benedicta and Egbo, 2005).

## 3.3 RESEARCH METHODOLOGY

A research strategy is the overall plan that determines how to accomplish the research objectives by answering the research questions (Saunders et al. 2009). According to Kothari (2012), research methodology refers to the technique of obtaining, systematizing and examining data. The nomination of the research methodology depends on the type of research questions. The common research approaches are qualitative, quantitative and mixed methods.

### 3.3.1 Quantitative method

A quantitative research approach is one in which the person investigating primarily makes use of positivist claims to collect data and develop knowledge on predetermined instruments (Creswell 2013). The quantitative research strategy generally involves the collection and conversion of data to produce statistical calculations in a numeric form through the use of surveys, experiments and prearranged instruments. The quantitative research method aims at quantifying the data to generalize the results and to measure the sample (Mark et al., 2005). This approach employs closed-ended questions, numeric data, pre-defined approaches, can involve measuring and may be automated (Creswell 2013). The key strength of quantitative research is that data can be aggregated and summarized by statistical analyses.

### 3.3.2 Qualitative method

McMillan and Schumacher (2009) define qualitative research as an inductive process primarily used for organizing data into a set of groups in order to identify the patterns among those categories. A qualitative research approach employs open-ended questions and image or text data (Creswell 2013). Qualitative research often deals with

social phenomena and explanations which answer questions that begin with “How” and “Why”. Qualitative research can also be purely descriptive.

Qualitative research will be utilized in this research study to gather data in order to obtain a detailed understanding of how mobile learning is currently used in education. As noted by Hancock (2009), the qualitative approach is concerned with individual’s opinions, feelings and experiences to discover unanticipated occurrences. For that reason, the qualitative approach is deemed suitable to this study as it will allow the researcher to understand the experiences and perceptions of learners currently using mobile tools for learning purposes in one advantaged secondary school. The qualitative method is appropriate for this research project as the intention of this study is to discover unanticipated occurrences (Jacobs, Kawanaka, and Stigler, 1999) and to understand the phenomenon of how mobile learning is used and adopted to promote learning.

Corbin and Strauss (2008) points out that the researcher using a qualitative approach should have good listening skills as the goal of the approach is to understand the personal meaning of the phenomenon studied. According to Jacobs et al. (1999) when unanticipated occurrences are to be studied the qualitative approach will be appropriate for that study.

### 3.3.3 Mixed method approach

This pragmatic research approach involves mixing qualitative and quantitative research methods to complement each other; pragmatic research is not fixed to a specific approach. Pragmatic researchers are concerned with the research problem instead of the method to use, thus the researchers have the flexibility to mix and match any of the research approaches (Creswell 2013). Several writers, like Cherryholmes (1992), Patton (2002), and Creswell (2013), believe that we need to stop asking many questions about the laws and reality of nature but “to simply change the subject”. The Pragmatic approach is not devoted to any philosophy; this approach employs both open-ended and close-ended questions, both qualitative and quantitative data analysis and both emerging and predetermined approaches (Creswell 2013).

### 3.3.4 Case study design

According Yin (2009), the aim of case study design is to obtain a detailed understanding and views of the underlying dynamics of a precise situation. A case study is an empirical or holistic investigation about a specific fundamental phenomenon within a natural setting (Creswell 2013). This type of empirical study involves gathering in depth data from a wide variety of sources, such as group discussions, face-to-face interviews, participant observations, reports and documents.

According to Yin (2009), case study research can be used to explain, explore and describe in detail what happened in the program and why. The case study method enables the researchers to study beyond quantifying the data and to deeply understand the participant's perspective through their behavioural situation (Zainal 2007).

The three categories of case study shown below (Table 5) were reported by Yin (2009).

| Category | Aim | Example |
|---|---|---|
| Descriptive | To describe in depth the phenomenon studied. This type of case study is suitable when the researcher conducts the research study in a real-life well-defined context. | Narrative writing |
| Exploratory | To explore any phenomenon interesting the researcher attempting to discover and examine the observed phenomena.<br><br>This type of case study is suitable when the expected outcome of the research has no visible or single set of outcome. | Pilot study |
| Explanatory | To closely examine the intervention studied at a deeper and inner level attempting to describe the phenomena in the data. | Multivariate and Complex |

| Category | Aim | Example |
|---|---|---|
| | Consists of an accurate interpretation of the facts of the phenomena. This type of case study is suitable when the event/case being studied is too complex for the experimental and survey approaches. | cases. |

*Table 5: Three categories of case study*

Explanatory case study will be used in this study to gain an in-depth understanding of the learners' behaviours at a single school related to mobile learning and the study will interpret their actions as a single group. A case study is suitable for this research project because the focus of the study is based on a single phenomenon in a real-life well-defined context; and the study involves "how" questions. As defined by Gillham (2000), a case study is an investigation that seeks to answer a particular research question and it is suitable in situations where circumstantial conditions of the phenomenon being studied are critical and the researcher has no power of controlling the proceedings as they unfold.

Given that the interpretive paradigm is adopted in this study and the types of research questions identified, the case study approach is deemed to be a suitable approach for this study because it will provide a methodical approach of gathering data, analysing the data and interpreting the data, therefore the research problem will be understood.

## 3.4 CASE STUDY DESCRIPTION

This study will be conducted in a private high school located in an urban area; the school is based in 243 Suid Street, Polokwane. The school started operating in 1994 with only two classes for Grade one learners; the school has grown over the years to cater for all primary and secondary classes. In 2014, there were over 4800 learners with 134 classrooms and 66 hostels for learners from Grade one till Grade twelve.

The aim of this study is to engage with two teachers and fifteen learners in Grade eleven, attempting to understand the digital educational technologies currently used as

a means to enhance teaching and learning in that particular school. This school was chosen firstly, because the teachers and learners integrate technology in their learning.

Secondly, the researcher was schooled in Northern Academy and mobile technologies were not used at that time therefore, the researcher was interested in understanding the concept of learning through the use of mobile technologies in this familiar environment. Moreover, it is challenging to obtain permission to conduct research in any school if there's no established relationship and hence the fact that the researcher has some existing connection to the school assisted her in getting permission.

This research is expected to benefit the any Education Department, researchers, educators and learners attempting to enhance or implement mobile tools in learning. The school sponsors the Edu-pad (the technology used) to reduce the cost to learners; learners buy the Edu-pad at a subsidized price. In the recent school letter of Northern Academy, it is reported that Edu-pad are sold at R1050-00 per tablet (Northern Academy...2015). All the learners in all grades each have sole use of the mobile tool (9.7" touch screen tablet) for learning. Teachers in the case study have also used interactive whiteboards since January 2013 to integrate with the use of the Edu-pad. Teachers and learners in the case study are living proof that mobile technologies are being introduced in the education sector.

But, how are these devices utilized for learning?

The findings and discussions chapter of this research project will describe in detail the purpose of using mobile tools in education at that particular school, the features of those mobile tools and the reasons for integrating mobile technologies into learning. The chapter will also attempt to answer all the research questions and will describe in detail the participant's experiences and perceptions about learning using mobile technologies.

The objectives of this study is to understand the aim of using 9.7" touch screen tablet in education, to understand how learners in the case study experience and perceive mobile devices for learning, to understand the teacher's role in the mobile age classroom and to also understand how are the teachers supporting the learners in learning using mobile tools.

## 3.5 DATA COLLECTION METHODS

Face-to-face, unstructured interviews with students will be conducted in a safe, quiet, empty classroom to explore the viewpoint of learners on the use of mobile communication tools for learning. The key purpose of this method is to create an open discussion (Yin 2009) and according to Gillham (2000) interviews allow the participants to be open about their feelings when answering the research questions.

Interviews are appropriate when there is a need to gain reflective knowledge from the participants (Cohen 2000). This method is suitable for this research as it will allow the researcher to answer the question "*How do learners experience and perceive mobile devices for learning*?"

Teachers will also be interviewed to get an understanding of the mobile learning strategy and their role in motivating and supporting the learners, attempting to understand "*How are teachers motivating and supporting the learners in learning using mobile technology?"* and "*What learning content is being taught using mobile technologies*".

The interviews will be scheduled with all the participants, conducted in English, audio recorded into a mobile phone and notes will be taken during the course of the interview. The participant's gestures during the interview will be observed by the interviewer and notes will be taken to describe the participant's experience in depth.

Data will be analysed using the recorded interviews with participants for qualitative data analysis. The learners and teachers responses will be critically examined using the FRAME model by taking into consideration the physical characteristics of the mobile device used for learning, focusing on the individual characteristics such as prior knowledge, learning styles, behaviour and personal history of the participants and by also taking into consideration the cultural beliefs, values and social context of learning.

According to Rubin and Rubin (1995, p. 17) "qualitative interviewing requires intense listening, to hear the meaning of what is being said".

## 3.6 ETHICAL CLEARANCE

The study will be conducted in a private school; therefore permission from the Department of Education is not required. The principal of the school is authorized to give permission to conduct research and to approach the teachers and learners.

On the 29 September 2014 the principal of Northern Academy approved the researcher's request to conduct research at the school.

The teachers will be approached by the researcher so that she can explain the purpose of the research and outline the roles of the participants. Once there is an understanding between the researcher and the teachers, the teachers will schedule a meeting with the learners and the purpose of this research will be explained to the learners.

Seventeen interviews with the participants individually are planned, consisting of 15 interviews with the learners and 2 interviews with the teachers. Interested participants, who volunteer to participate, will each be given a consent form. The consent form is to be signed by each voluntarily participant above 18 years old or by the parent or guardian of the learners who are under 18 years old; an appointment will be made with each voluntarily participant.

Voluntarily participants are encouraged to raise concerns or ask questions at any time of the interview and may withdraw from the research at any time without any negative consequences. The interviews will take less than 40 minutes and should the time be exceeded the participants have a right to end the meeting.

For ethical purposes, the participants' details will not be disclosed and their responses will remain anonymous. The seven steps shown below in Figure 3 will be followed in this research study.

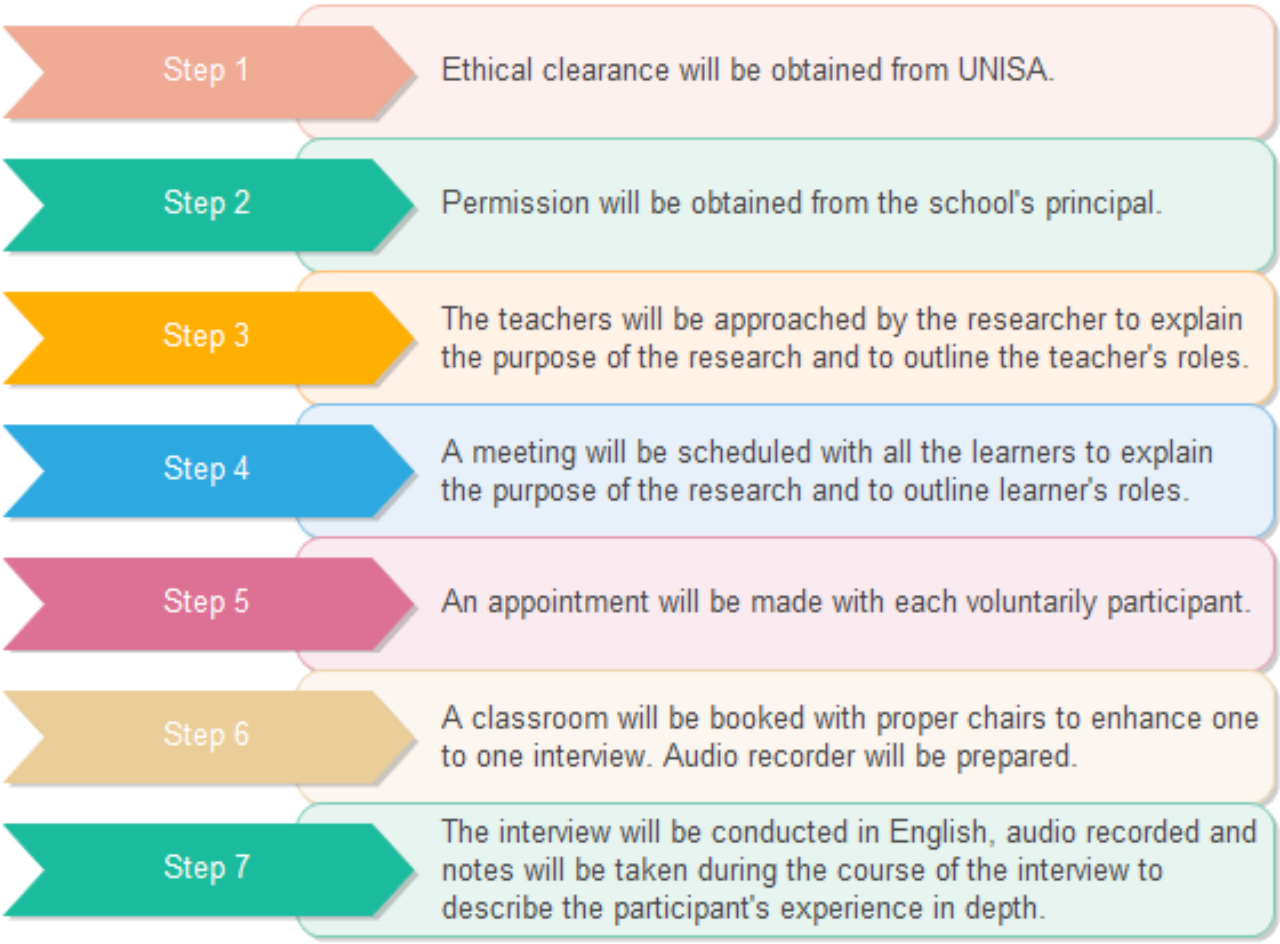


*Figure 3: Research plan for data gathering*

## 3.7 CONCLUSION

This chapter presented the research methodology, design and data collection methods selected for this research study, describing in detail the rationalisation underpinning the followed procedures and how the followed procedure will help in answering the research questions. Before incorporating any mobile tools in education, it is important to investigate and understand how learners perceive and experience mobile technologies for learning purposes therefore this research project will enable the researcher to study learner's interest concerning mobile learning. Moreover, the aim of this study is to add to existing research and to provide recommendations on how future researchers can enhance the learner's experiences beyond providing digital versions of text books.

This research project employs a case study design to obtain a detailed understanding and views of the underlying dynamics regarding learning using mobile technologies in a privileged high school. The Interpretivist paradigm will be used to understand the views, background and experiences of the participants in the case study. The case study utilises a qualitative research approach to obtain a detailed understanding of how mobile learning is currently used in education.

The exploratory nature of this study indicates that a sample of two teachers and fifteen learners in one privileged high school is small thus the findings of this study cannot be generalised to all grade eleven teachers and learners in secondary schools.

The learners and teachers responses will be critically examined using the FRAME model. There will be a detailed discussion in the next chapter, describing the analysis of the data collected.

# 4. RESEARCH FINDINGS AND DISCUSSIONS

## 4.1 INTRODUCTION

As stated in prior chapters, the aim of this research project is to complement the current knowledge of mobile tools in education by looking at one particular case in a large, privileged high school named Northern Academy. According to Vavoula and Sharples (2008) before evaluating mobile learning, it is important to examine the tools, activities, the social and physical setting where learning takes place and the methods used for learning and the advancement of learning across all contexts; thus the objective of this study is to understand the tools, how they are being used for educational purposes and the mobile learning activities currently used in that particular school and to also evaluate the learner's experiences and perceptions about mobile learning in order to get a deeper insight on how learning using mobile tools supports the learner.

Koole's (2009) FRAME model as discussed in chapter 2 will be used as an analysis tool in this study. The FRAME model will enable the researcher to evaluate the usefulness of mobile learning in Northern Academy as the focus of the research will be on the learner's experiences, the device used for learning and the social aspect of learning using mobile tools. Traxler (2007) states that there are various challenges in relation with evaluating mobile learning; the major problem is conceptualising the characteristics of what is deemed an appropriate evaluation of mobile learning. For example the evaluation of conceptualising mobile learning in terms of the experience of the learner will differ from conceptualising mobile learning in relation to hardware platforms. This paper explores the relationship between education (what is being taught), society (individual learners and their learning preference) and technology (mobile tools used for learning), conceptualising the learner's perspective. The FRAME model emphasizes the learner, device and social aspects hence the model is deemed appropriate for this research project.

Explanatory case study method proposed by Yin (2009) was used to describe in detail the participant's perspective; how learners in the case study experience and perceive mobile learning and why. The case study utilises a qualitative research approach; the

qualitative data was obtained through face to face unstructured interviews. The unstructured interviews were conducted at the school's premises with two teachers and fifteen learners in grade eleven in order to understand the mobile educational technologies currently used within one particular context as a means to enhance teaching and learning. The numbers are sufficient because the aim of this research study is to intensely examine the study and to conduct an in-depth conversions with the participants, the results of this research study should not be generalised too extensively thus it is necessary to view the research outcomes in the same context it took place.

This chapter will review the research findings and compare the findings with the literature reviewed in chapter 2. The purpose of this chapter is to interpret and analyse the gathered data. For ethical reasons, the participants' details will not be disclosed and their responses will remain anonymous.

### *Participants*

The participants for this small scale study consist of two teachers with computer skills and fifteen learners in grade eleven. The two teachers will be referred to as 'teacher 1' and 'teacher 2'. The learners will be referred to as 'the learners' and sometimes using a percentage of the responses. The researcher will be referred to as the singular form of the first person 'I' and sometimes as 'the researcher'.

### *Research background*

Northern Academy is a co-educational, independent, English medium, private school catering for approximately 482 learners in grade eleven. The school offers aftercare and hostel facilities for grade R to grade twelve learners. The school is managed by Curro Holdings Ltd and is located in an urban area of Polokwane. The majority of the learners attending the school reside in Limpopo province and they are from privileged families because the fees at Northern Academy are much higher than average schools in Limpopo. The teachers supporting the learners have the necessary qualifications for teaching and they are computer literate (trained on facilitating and teaching using technology).

The school was established in 1994 with only 88 learners and over the years has become one of the predominant educational institutions in Limpopo with several recent awards for being the best independent school. Grade ten to grade twelve learners are offered Information Technology for which the prerequisite is 50% for Mathematics, and Computer Application Technology as an eighth subject to ensure that learners understand the protocols, standards and concepts of Information Communication Technology. The school has a computer lab and classrooms equipped with desktop computers and a wide display interactive whiteboard; these classrooms are used only for teaching and learning the ICT subjects. All learners in Northern Academy are required to have an Edu-pad and to bring the Edu-pad daily to the classroom for all the subjects. The grade twelve class learners of 2013 obtained a 98.45% pass rate, with a 100% pass rate for Information Technology. The school provides learners with a Wi-Fi internet connection in all the classes during the specified time period. The aim of the internet availability is to provide WWW access to the teachers and the learners and to facilitate instantaneous communication among them, and hence to enable self-directed learning and rapid access to digital learning resources.

On the 13th of October 2014 the researcher approached the two teachers, unannounced and individually, presenting to them the letter of approval signed by the principal of Northern Academy to conduct the research at the school and the ethical clearance obtained from UNISA. The purpose of the research was explained to the teachers and at the end of the discussion there was an understanding between the researcher and the teachers concerning the aim of the study, the teacher's and the learner's role. The researcher scheduled meetings with the teachers to discuss the first and the last research question "Which educational content is being taught through mobile technologies?" and "How are teachers supporting the learners in learning using mobile tools?" in an attempt to understand the role technology plays at that school and to understand the teacher's role in motivating the learners on using mobile technology.

Once the unstructured interviews with the teachers were completed, the teachers introduced the researcher to the learners in their classes, gave an overview of the research study and advised interested learners to remain in class after school. The

researcher explained the purpose of the research in greater depth to the learners after school. Interested learners were given consent forms and an appointment was made with each voluntary participant to discuss the second research question "How do learners in the case study experience and perceive mobile devices for learning?"

The fifteen interviews with the learners took place in the school's premises, after the learners had indicated their availability, their preferred time and place. The interviews were conducted in English and audio was recorded with the participant's approval. At the beginning of each interview, an informal chat with the participant was initiated attempting to make the learner comfortable. Before the learners could share their own stories I explained my lived experience at Northern Academy trying to build an open relationship with the learners. I explained how learning took place between the years 2000 to 2004 and in addition, I clarified the learner's role and the purpose of the study. At the end of the interviews I expressed my sincere appreciation and wished the learners best of luck with their studies. Though the interviews were audio recorded, I took notes to capture key ideas, the key ideas were used to guide and direct the next interview questions as a way to continue the interview and in some cases the key ideas were used to get a different perspective on the key ideas and for highlighting the covered concepts. At the end of all the interviews, the unstructured data was analysed and grouped to provide context and to create meaningful research results about what the data said. The sections below will discuss in detail the participants' responses to the research questions, analyse the gathered data and provide the research findings. The findings will be reported in the context of the FRAME model

## 4.2 RESEARCH QUESTION 1: 'Which educational content is being taught through mobile technologies?'

The results of the unstructured interviews focusing on the Learner aspect and the characteristics of the mobile technologies used at Northern Academy will be illustrated in the following section; the questions are in the column chart diagrams followed by supporting evidence from the unstructured interviews. The participants' responses to the unstructured interview questions made up the data which was entered into an Excel

spread sheet; the column chart diagrams will be used to group, organise and illustrate the participant's response into a set of groups.

As mentioned in chapter 3, Northern Academy has been using interactive whiteboard technology and the Edu-pad (the tablet) since January 2013 and all the classrooms have an interactive whiteboard where the projector is permanently set up. The interactive whiteboard and the Edu-pad will be described in this section. This section will also give the teachers' detailed responses relating to the content, activities and the purpose of using these electronic technologies in education.

Technology was introduced at that school to enhance the current teaching practices and outcomes. Instead of teaching using the old form of the whiteboard teachers now use the interactive whiteboard and the Edu-pads were introduced to support the current learning methods to empower learning beyond the classroom. All the grade eleven teachers have access to a whiteboard and a laptop provided by the school to connect to the projector - the teachers are confident of their ability to facilitate and teach using the currently used technologies.

The interactive whiteboard is a classroom tool that enables the teacher to display the learning content to the learners providing a wide display; diagrams can be animated and interactive; the tool adds good value to the classroom activity facilitating visual and collaborative learning.

The Edu-pad is the mobile learning tool used by the learners inside and outside the classroom. These technologies allow the teachers and the learners to share learning resources, communicate with each other and to exploit digital ways of teaching and learning. The intention of learning with the aid of technology in Northern Academy is to stimulate an interest in learning and to promote learning by enabling learners to learn at any time and in any location. The interactive whiteboard enables the teachers to use technology in a way that optimises the use of the Edu-pad. For example, the teacher uses the laptop to prepare the object lesson to be taught in the classroom (using Microsoft Word, a Power Point Presentation or scans of the pages) and the content is loaded into the laptop; the portable lightweight nature of the Edu-pad and the laptop

enables the learners and the teachers to carry the content to any location without having to carry a bag full of textbooks. Learners are able to switch on their Edu-pads, connect to the internet and open the shared folder to access the teacher's content; this means learners do not need to take notes from the whiteboard because the learning material is already available to all the learners.

Researcher: What is the function of Interactive whiteboard?

Teacher 1: "Interactive whiteboard is a classroom technology used as an instructional tool to display and teach the learning content in an efficient manner". Teacher 1 characterised Interactive whiteboard as "a board that makes learning come alive because of the interactive and animated aspect of the tool". Teacher 1 further explained that the tool helps in managing the instructional time; instead of spending more time writing on the black/white board, the learning content is structured beforehand and designed including visual effects. As a result, learners are more attracted to, involved with and participate in activities relating to the presented course content.

The efficiency of the interactive whiteboard will be explained in the next question 'what is happening in the interactive whiteboard classroom?'

Teacher 2: "Interactive whiteboard help in structuring the classroom lessons and it enables large visual display; the presented content can later be manipulated and used by learners for revision purposes or to create their own multimedia content". For example, learners can edit and modify the downloaded content presented by the teacher, personalising the notes from the discussion according to their own preferences, adding text, audio or visual aids to the content. Teacher 2 further explained that the whiteboard's touch sensitive screen allows the presenter to reinforce learning by simply touching the screen; manipulating, controlling and demonstrating the content on the whiteboard without using the mouse.

Researcher: What is happening in the interactive whiteboard classroom?

Teacher 1 and 2 are in agreement that: “Interactive whiteboard create engagements among the class. Teachers and learners are able to manipulate objects on the whiteboard creating interaction among the learners which adds motivation and interest to the classroom lessons”. Teacher 1 furthermore reported that in an interactive classroom, teachers are not totally focussed on the whiteboard; rather they interact with the learners ensuring that learners are engaged and that there are tasks that require the learners to participate. Teacher 2 reported that classroom lessons are structured in an interactive classroom, learners can be instructors and learning is collaborative.

“Teachers upload the learning content to the drop box application using the Wi-Fi and learners log into the static application using the Edu-pad to access the shared files”.

Teacher 2, in the citation above, reported that the drop box free service enables the teachers and the learners to interact and share learning resources, *“Keeping track of all the learning files and documents can be a problem and the drop box creates an easy way of sharing and backing up the learning content, it is like a magic pocket - a single secure place for all the backed up learning material and the stored material can be accessed any time and at any place”.*

According to Teacher 1, the drop box is a multidimensional tool that can be used to store and synchronise the learning resources “*the teachers create a sharing folder and give learners the permission to access that folder by adding them as collaborators*”. Teacher 1 further stated that the sharing folder can be used by the teachers to make information available and the learners can submit their school assignments, time stamping the submission date and time. Learners can also share the drop box folders with each other and work together on joint assignments fostering teamwork and collaboration among the learners.

What is the Edu-pad?

Teacher 1: “The Edu-pad is the technology used by learners for communication and for learning purposes. The 9.7 inch touch screen Google Android tablet is sponsored by the school and the learners buy the Edu-pad from the school at a subsidised price; the school also provides technical support and maintenance of the Edu-pad. Learners are

also allowed to bring and use their own android tablet as long as it is a version 4 or above."

Teacher 2: "The Edu-pad enables learners to download the learning material presented by the teachers, to have access to a wide variety of information; it is a convenient tool for learning, enabling learners to learn anytime and anywhere. With the Edu-pad and Wi-Fi availability learning is not only limited to the classroom content, learning is mobile and technologically advanced to support mobile learning." Teacher 2 further reported that before the introduction of the Edu-pad, teachers were printing a lot of learning documents, but currently due to the advancement of technology and the use of the Edu-pad teachers can instantly share learning documents without being in the classroom and having to print the files.

The results of the unstructured interviews revealed that:

- Teachers are familiar with interactive whiteboard and they all know the characteristics of teaching using interactive whiteboard.
- Learners are more comfortable with mobile technologies; they all have prior knowledge and experience in using mobile devices.

This finding indicates that both the learners and the teachers can engage in the mobile learning context.

## 4.3 RESEARCH QUESTION 2: How do learners in the case study experience and perceive mobile devices for learning?

This section will analyse the learner's experiences and perceptions about learning mediated by the use of mobile tools, focusing on the individual characteristics such as learning styles, behaviour and personal history of the participants and also taking into consideration the learner's beliefs, values and social context of learning.

Figure 4 represents learner's responses to: 'what are the applications that you use on the Edu-pad for learning purposes and how often? '

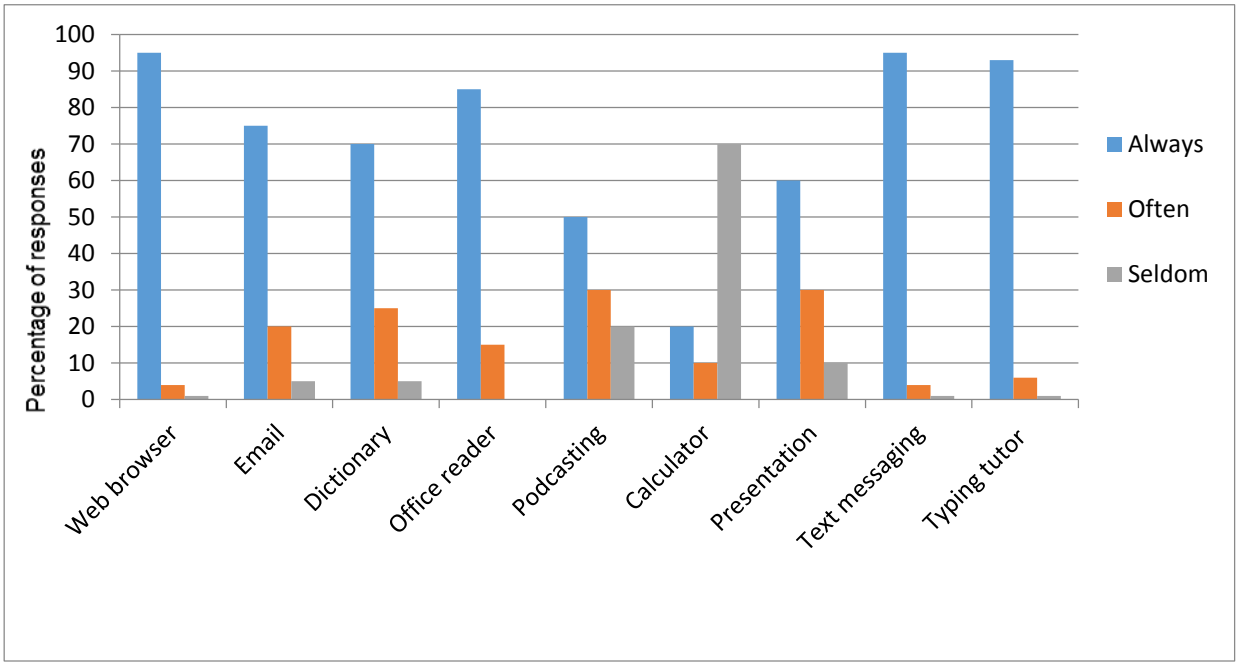


*Figure 4: Applications used on the Edu-pad for learning purposes*

All the unstructured research questions relating to the programs being used on the Edu-pad were used to answer two higher level research questions 'what are the applications that you use on the Edu-pad for learning purposes and how often?' According to the learners' responses in Figure 4, the majority (>90%) prefer using the Edu-pad for Web browsing, the typing instruction program using the touch keyboard and for communicating with their peers through text messaging. 85% of the learners use the office reader for viewing their documents and for completing their online learning activities such as homework and assignments.

Figure 5 represents learner's responses to the question: 'what are the purposes of using the Edu-pad?

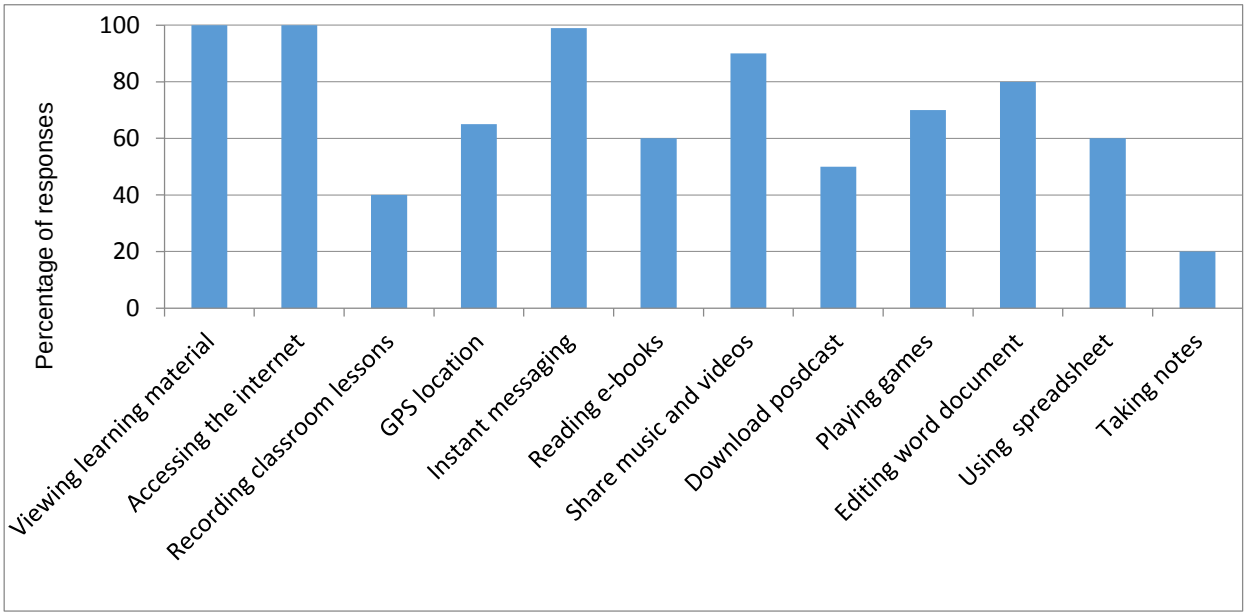


*Figure 5: The purposes of using the Edu-pad*

As can be seen in Figure 5, all of the learners interviewed in this research study use the Edu-pad mainly for viewing the learning material and accessing the internet. Figure 5 is an extension of Figure 4, learners clarified that they use the web browser to lookup information on the internet and to communicate with their peers regarding any social and learning matter they come across. Learners described the Edu-pad as an easy-to-use tool for accessing information. Communication among the learners is mediated by the use of the Tablet as 95% of the participants have a preference for chatting with their mates through instant messaging. One learner stated that *"it is so simple and saves airtime to chat with mates through instant messaging. The good thing about messaging is that you can always refer back to the text*". Some of the learners reported that they exchange information by pairing compatible devices through Bluetooth; once the devices are paired and connected any content can be shared.

"I use the Edu-pad to determine the geographical location of my friends, every time they update their status or check-in on the social networking media that makes me aware of their location and their location will determine our interaction." The learner further explained that if the location service of the friend is turned on that will authenticate the location of the device. If the friends are at school in a classroom the learner will know

that the response time will be delayed and if the location is anywhere travelling in a car the learner will know they will get a prompt response. Some learners reported that if the geographical location of the friends is nearby they will locate their peers and interact with them face to face.

When asked do you think you can achieve the same educational outcomes by yourself without the use of technology (the Edu-pad), the majority of the learners reported that they like learning using the Edu-pad. However they can obtain the same results by themselves because anything that can be done through technology can also be done manually without the use of technology and they won't have to worry about the limitations of learning using mobile tools. This finding indicates that learners believe that they have the capability to achieve without the use of technology.

The majority of the learners indicated that they like to use the Edu-pad mainly to access the internet. This finding shows that learners like to be connected to the internet and they conform to the "Net Generation" as described by Oblinger, Oblinger and Lippincott (2005). This finding also indicates that the Edu-pad as described by Viberg and Grönlund (2013) enables learners to access a wide variety of information through the World Wide Web and the Edu-pad enables collaborative learning for knowledge sharing (Looi, Seow and Zhang, 2010).

20% of the learners reported that they use the Edu-Pad for taking notes. Note taking is a learning practice whereby the learners interpret the discussed topic to shape their understanding and the notes taken can be used for revision purposes. However, 80% of the respondents reported not using the Edu-pad for taking notes, declaring that they prefer their pen and paper for taking notes

Figure 6 represents learner's responses to the statement: 'using the Edu-pad enhances my knowledge in learning'.

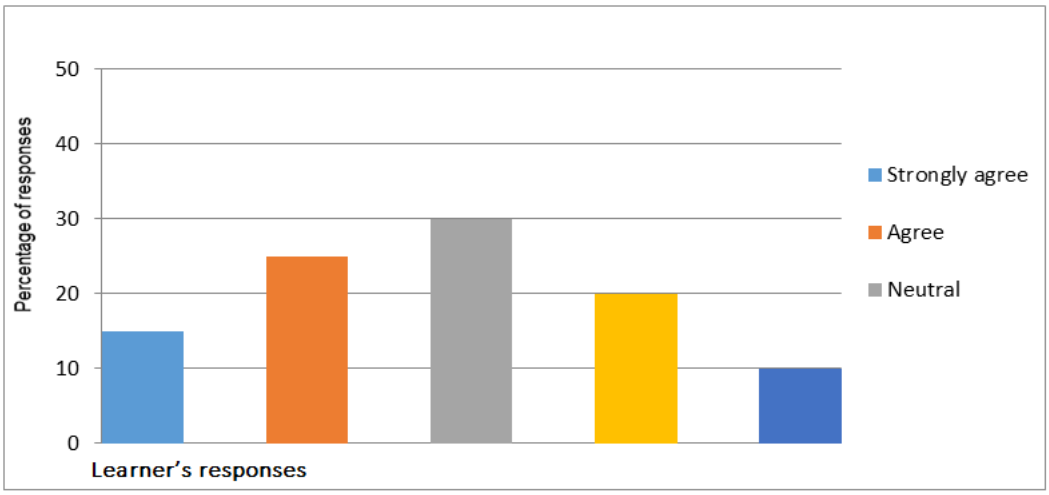


*Figure 6: Using the Edu-pad enhances my knowledge*

Learners' responses to the unstructured interview questions indicate that learners are enthusiastic about mobile learning but in contrast, as can be seen in Figure 6, when evaluating the statement: 'using the Edu-pad enhances my knowledge in learning' a large portion (30%) of the learners were neutral in their response and uncertain as to whether mobile learning increased their existing knowledge. Figure 4 indicates that the Edu-pad enables the learners to interact socially and to access a wide variety of information to enhance their knowledge. This finding shows that mobile learning is fun and learners generally learn without knowing they are learning.

## 4.4 RESEARCH QUESTION 3: 'How are teachers supporting learners in using mobile technology?'

As already mentioned, the teachers are confident of their ability to facilitate and teach using the current technologies, but how are they motivating and supporting learners in using digital technology? This section will address the teacher's support to the learners in the mobile age, attempting to understand how the teachers are promoting learning using technology and what the teachers are doing to ensure that learners make use of the devices.

Teacher 1: "Learners are given activities that require the use of the Edu-pad; they are encouraged to search and research possible solutions using the Edu-pad and are

expected to bring the Edu-pad to class daily; the aim is to promote the use of mobile technology and to empower mobile learning." This finding indicates that learners are encouraged to construct new knowledge, researching possible solutions enhances the learner's understanding enabling the learners to interpret solutions based on their own understanding.

Teacher 2: "Learners are permitted to take the Edu-pad outside the classroom and are encouraged to learn at home and in any location, to experiment and see the sights of the tool, they are taught safety and etiquette in order to establish the responsible use of the internet and the Edu-pad. Although we have computer-assistant instruction program, the teachers are present in the classroom to support and help the learners when needed." Teacher 2 further explained that the areas covered in the computer-assistant activities will first be presented by the teachers and at the end of the lesson the learners will be assigned a computer-assisted task to recap the lesson learned. The teacher will be present to direct, guide and help the learners with the subject material and their questions, to ensure that the devices are being used productively and to make sure that learners receive immediate and individualised training or response. This finding indicates that mobile technology (computer-assisted instruction) is not used to replace the teachers hence the teachers are present in the classroom to support the learners.

What happens to the learner who is shy to ask questions and is not engaged in participatory learning, is there any forum where those learners can ask or post questions?

Teacher 2: "We motivating learners to speak out and to improve their presentation skills, hence we have oral tests. However, the school is preparing a student hub for communication, a platform that will enable communication among the teachers and learners." Teacher 2 believes that it is vital for the education system to accommodate all learners in the learning process; to ensure that all the learners are supported in the same way to make learning achievable and accessible. This finding indicates that

mobile tools can facilitate a communication platform that will enable all (confident and unconfident) learners and teachers to share their ideas and experiences. Though teacher 2 reported that there is a plan in place to cater for those learners, that plan is not yet implemented and as a result not all the learners will benefit from learning using mobile tools.

Do you see mobile learning being utilised at Northern Academy in the future?

Teacher 1: “Absolutely, the rate at which technology is progressing and the competition among innovators can only mean that there is a bright future for supporting learners through the use of technology and for advancing the current teaching and learning methods”. The teachers believe that learning with mobile tools is very valuable and will be continued in the future at Northern Academy and across all the schools. This finding indicates that the teachers are well aware of the progression of technology in the education sector and they are confident that mobile learning will be utilised in the future.

Is mobile learning supporting and making a difference to learner’s achievement?

The findings in this research study did not demonstrate a relationship between mobile learning and learner’s achievement. The two teachers did not disclose the learners’ academic achievements and since the learners’ progress reports were not part of this research study, the two teachers were asked the relating question “what kind of contribution is mobile learning making to the learners?” The two teachers believe that the Edu-pad makes a positive contribution to education and to the learners in Northern Academy. The research findings clearly indicate that learners have positive attitudes towards mobile learning and the majority of the learners reported that the Edu-pad improved communication among themselves and learning is open and social through text messaging services, email and social networks. The learners also indicated that they perceive mobile learning as an expected way of learning and not as an inspirational tool.

Figure 7 provides an overview of the learner’s concerns regarding learning using the Edu-pad. “The screen breaks easily, it is much easier learning using the textbooks

because you'll never get battery low or safe mode on the text book and you do not have to worry about electricity or connectivity".

**Device usability**

A large portion (60%) of the learners reported that the screen of the Edu-pad breaks eaisly, thus the Edu-pads are sometimes inconvenient to use. This finding indicates that the physical characteristics of the device needs to be taken into consideration when employing mobile devices in education.

**Battery life**

The majority (>90%) of the learners are most concerned with the battery life of the Edu-pad, reporting that the battery does not last the length of a school day. This finding shows that Tablets need constant charging and learning takes place through the use of Edu-pad only when the Edu-pad has battery power remaining.

**Lack of communication with the teachers**

Learners when asked 'how do they communicate with the teachers outside the classroom using mobile tools when faced with a problem or needing help?', they replied "communication with the teachers occurs only inside the classroom verbally and not through mobile tools" this finding shows that learners are not able to exchange information anytime, anywhere with their teachers. Most (>80%) of the learners stated that it would be good to have some of the questions answered outside the classroom instead of waiting for the next day. 8% of the learners reported that it would be nice to anonymously ask questions, raise issues or concerns though mobile tools.

**Slow data connection**

The respondents were dissatisfied with the slow bandwidth and Wi-Fi (local area wireless technology) used for connecting to the Internet, reporting that sometimes it's slow to electronically exchange data or to connect to the Internet. Learners' feedback shows that when the network is slow, it will take more time to lookup information, download or upload any material.

*Figure 7: Learner's concerns regarding learning using the Edu-pad*

## 4.5 SUMMARY AND DISCUSSION OF THE RESULTS

The FRAME model helped in investigating the mobile tools currently used as a means to enhance teaching and learning in a privileged high school. The table shown below (Table 6) covers the research findings and discussions.

| Aspects | Reporting and Interpreting data |
|---|---|
| Device usability aspect (A) | The survey shows that 80% of the learners are pleased with the use of Tablets for learning purposes - the learners are in agreement that the mobile tools are portable and they are happy with the output capabilities of the device. This finding show that mobile devices can be carried to any location and learning can occur in any location however the learners have reported that the device is not usable if out of power and it is difficult to use the device when the internet connectivity is slow. Learners also indicated that the screen of the mobile device breaks easily; this finding indicates that the physical characteristic of the device is at times inconveniencing the learning. For example, when the screen of the device is not working, learners take the device to repairs as a result the leaners won't have access to mobile learning. |

| Aspects | Reporting and Interpreting data |
|---|---|
| Learner aspect (B) | 99% of the learners reported having the background needed and knowing how to use mobile devices. They also stated that the transition to using mobile devices in education is exciting; this balances well with their social and daily activities. This finding shows that learners are familiar with mobile technology; they are ready and prepared to learn using mobile technologies. According to teacher 1 the learners are given activities that require the use of the Edu-pad; they are encouraged to search and research possible solutions using the Edu-pad this finding indicates that teachers support the learners to construct new ideas. |
| Social aspect (C) | According to Viberg and Grönlund (2013) it is important for learners to interact socially. 14 of the 15 learners strongly agree that the Edu-pad made learning interaction more frequent; learners communicate with each other via instant messaging about topics discussed in the classroom and about any social matter. This finding shows that learners use their portable mobile devices to aid their learning in any location and to socially interact. |

| Aspects | Reporting and Interpreting data |
|---|---|
| Context learning (AB) | 99% of the learners strongly agree that the Tablet provides them with access to a wide variety of educational resources (online access, learning material etc.) and learning can occur anywhere and anytime. This finding indicates mobile learning empowers learning beyond the classroom. As emphasised earlier, the teachers design and structure the learning lessons ahead of time, the laptop enables the teachers to prepare the lessons to be presented and, as a result, learners can download the discussed lessons and change the presentation to fit their learning style. This finding shows that mobile tools firstly, enable the learners to engage in different activities and secondly, create content suitable to their learning preference. |
| Social computing (AC) | Some of the learners reported that they exchange information by pairing compatible devices through Bluetooth while other learners indicated that they use the Edu-pad to determine the geographical location of their peers. The findings described above show that mobile tools can effortlessly connect with other compatible devices through Bluetooth connections and can identify the current location through GPS. The devices enable learners to collaborate and interact with each other. Learners are able to exchange information at appropriate times and they can take part in a diverse community. |

| Aspects | Reporting and Interpreting data |
|---|---|
| Interaction learning (BC) | The research findings show that 95% of the learners noted that they use the Edu-pad for instant messaging (through Windows messenger, MXIT, WhatsApp etc.) which shows that learners are digitally connected and they regularly interact with each other. These communication channels enable learners to share their experiences and to get quick feedback. This means that collaborative learning takes place inside and outside the classroom. |
| Mobile learning process (ABC) | According to the FRAME model, effective mobile learning results from the intersection of (A), (B) and (C). The data gathered through unstructured research questions indicates that learners in the case study are using mobile tools for learning purposes and they have positive attitudes towards mobile learning; learners are more engaged in the interactive classroom and in the learning process than they would be in a traditional classroom and the interaction among the learners has improved significantly since the introduction of the Edu-pad.<br><br>The Edu-pad improved collaboration between the teachers and the learners. |

*Table 6: Research findings and discussions*

Figure 8 summarizes the uses of mobile technologies as discussed in chapter 2 'how mobile technologies can be used for learning'.

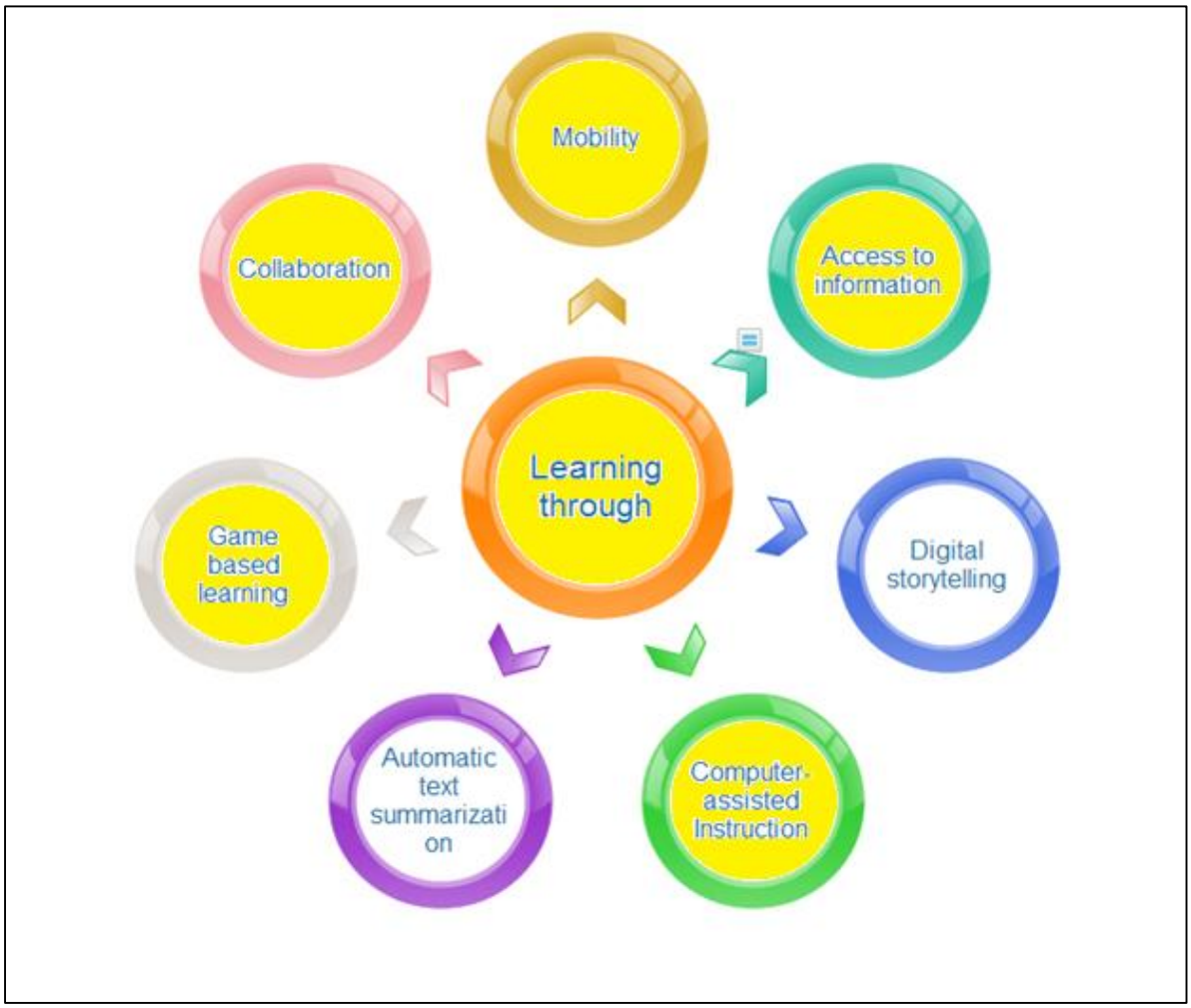


*Figure 8: Uses of mobile devices for learning (Adapted from Naismith et al. 2004)*

The concepts highlighted in grey were reviewed in the literature and are covered by the teachers' responses to the question 'which educational content is being taught through mobile technologies?' The concepts that are not highlighted were discussed in chapter 2 and are not part of the learning content for learners in the case study.

As already mentioned, the laptop and the Edu-pad enable the teachers and learners in the case study to have **access to information,** to be able to access a wide variety of information using the internet or the stored information loaded into the laptop/ the Edu-pad. The **mobility** feature of the laptop and the Edu-pad enables both the teachers and

the learners the opportunity to learn beyond the classroom because the tools are lightweight and hence they can be carried to any location and learning can be mobile. The research results indicate that the Edu-pad allows learner-centred use because the device is used by learners to personalise the learning content, for collaboration and for communication. The interactive whiteboard is more useful for teacher-initiated use inside the classroom.

The interactive whiteboard is a digital tool that can be used to demonstrate or display learning content to make learning visual and **collaborative**. The laptop and the Edu-pad can effortlessly connect with each other for sharing learning content and learners are able to exchange information amongst themselves through various communication channels. Teacher 2 mentioned that **computer-assisted instruction** programs are being used in Northern Academy to carry out instructional activities and to encourage constructive learning. That means that learners can put the learned concepts into practice, making learning more active and relevant. 60% of the learners reported not knowing which application to download for educational gaming purposes. This finding indicates that **game based learning** is not utilised by learners in the case study. Gaming environments can provide the "Net Generation" with the flexibility to learn the very same way that they play, learn by doing and to become self reliant (Annetta et al. 2009).

## 4.6 CONCLUSION

The reviewed literature shows that learners' interaction with technology on a daily basis is rapidly increasing as learners are well aware of the evolution of technology.

The data gathered was not detailed but was sufficient to answer all three research questions. The data clearly indicated that more can be done to support learners through the use of mobile tools. From the unstructured interviews with the learners, it was found that learners like interacting with their peers using mobile tools. However, learners have only a vague knowledge of how mobile tools can support learning; they simply perceive the 9.7" touch screen tablet as an electronic version of their text books, convenient for chatting with their peers and for looking up information on the internet.

When asked about the educational games that can be used for learning, 60% of the learners reported not knowing which application to download for educational gaming purposes. This finding shows that learners like playing computer games for fun yet they do not know the significance of computer games for learning. The findings also revealed the educational content being taught through mobile learning and the support offered by the teachers to the learners in the mobile age.

The findings of this research study illustrate that the learners are familiar and fluent in using digital technology and they conform to “Digital Natives” as described by Prensky (2009). However learners are not benefiting fully from the advantages of learning using mobile technologies in education - there is still room for improvement and growth in Northern Academy to support learning through mobile tools and to enable learners to make the most of mobile tools. The findings have also indicated that learners are more engaged in the interactive classroom and in the learning process than they would be in a traditional classroom. Furthermore, the study has revealed that learners in the case do not know the importance of learning using the Edu-pad as a result learners perceive the Edu-pad mainly as a convenient tool for communication, an electronic version of their textbook, a tool used for downloading the discussed topics and learners also indicated that they perceive mobile learning as a digital expected way of learning. As already mentioned teachers in the case are confident of their ability to facilitate and teach using the currently used technologies, the analysis of this study indicates that the teachers are not fully supporting the learners or capitalising the most out of the mobile tools.

However, mobile technology has only been used since 2003 in Northern Academy; use can be expected to evolve as teachers gain experience and learners start using the Edu-pad from grade eight. It is likely that teachers will learn strategies and ideas for improving the mobile learning experience and for supporting all the learners in learning using mobile technology.

# 5. CONCLUSION AND RECOMMENDATIONS

## 5.1 PURPOSE OF THE STUDY

Mobile learning is one of the emerging strategies that can be used to support learning, enabling anytime-anywhere learning through digital technology. According to Kukulska-Hulme and Traxler (2005) learning is an on-going process for everyone irrespective of their age, nationality or gender; it is a process that can enhance one's knowledge and skills. For the purpose of this research the definition provided by Kukulska-Hulme and Traxler (2005) was used as the prime description of mobile learning. Mobile learning is a flexible way of learning, learning anywhere and accessing learning tools for educational purposes anytime, to compliment teaching and learning (Kukulska-Hulme and Traxler, 2005). Moreover, this study consider mobile learning to be playful and enjoyable thus learning and play need to be relevant to the learner's daily activities

The *context* of the study was considered as a physical setting where the learning activities takes place and content was considered as the learning activities facilitated by the teachers to the learners and *content* can also be the learning activities initiated by the learner based on their preference.

The main aim of this thesis was to study mobile learning conceptualising the learner's perspective, using the qualitative (observations, face to face unstructured interviews) data collection method. The investigation of this research project concentrated on mobile educational technologies currently used as a means to enhance teaching and learning in a privileged high school named Northern Academy, the study attempted to find out which digital tools were being used at that particular school and what purposes were they being used for; the study also attempted to understand the educator's role in the mobile age, how the teachers support and motivate the learners in learning using mobile tools.

This chapter will go into detail on how this study contributes to theory, practice and future researcher's work, moreover the chapter will explain the lessons learned during the course of this study, acknowledging the constraints of the study and listing the possible guidelines for future research.

## 5.2 THEORY USED TO GUIDE THIS RESEARCH

Koole's (2009) FRAME model as discussed in Chapter 2 was used to analyse the collected data. The FRAME model emphasises the aspect of technology and on the concept of learning by doing (constructivism) where the learners have the flexibility to learn in any location and to socially interact with other people. The FRAME model was deemed appropriate to guide this research study because the model considers learning to be socio-cultural in nature and it also looks at the individual aspects of learning.

## 5.3 SUMMARY OF THE FINDINGS

Learners and teachers at that school are familiar with learning and teaching using technology, teachers have been teaching using the projector and the whiteboard whereas learners have had access to computer labs equipped with desktop computers and ICT subjects are being taught at that school for grade ten to grade twelve learners. Technology was introduced at that school to enhance the current teaching practices and outcomes, instead of teaching using the whiteboard teachers now use the interactive whiteboard and the Edu-pads were introduced to support the current learning methods to empower learning beyond the classroom.

The results of this study show that participants in this case study believe that using mobile technology in education is both necessary and possible from the device usability aspect; they found the social technology to be highly useful for communication purposes. Despite all the identified challenges in learning using mobile technology, they described the devices as easy-to-use, portable and flexible.

As already mentioned, this study has provided ways of how technology is being used by the teachers and learners in the case study; the Edu-pad is used as a learning toolkit that enhances the learner's access to the learning resources and the interactive whiteboards is used to enhance the teaching protocols through collaborative content allowing the teachers to create interactive tasks for the learners. Teachers reported that they are encouraging the learners to become active constructors of knowledge, supporting them when they communicate about their experiences and ideas. Learners indicated that they use mobile devices inside and outside the classroom; they are given learning activities that require the use of the mobile tools.

Majority of the learners think of themselves as 'winners' (high self-efficacy).

For example, when asked '*do you think you can achieve the same educational outcomes by yourself without the use of technology (the Edu-pad)*', the majority of the learners reported that they like learning using the Edu-pad. However they can obtain the same results by themselves because anything that can be done through technology can be done manually without the use of technology. Majority of the learners didn't find the transition of using mobile devices in the classroom motivating instead they value the social aspect of mobile technology. This study indeed has indicated that digital natives as described by Prensky (2009) have positive attitudes towards learning using technology and they are more focused on the social aspect of the mobile tools, they learn by doing and they like to be linked to the internet.

## 5.4 THEORY

The completed work of this study contributes to the taxonomy[4] proposed by Gregor (2006) distinguished as a theory of explaining. The emphasis of the theory of explaining is more on answering and explaining the questions relating to "*how*" and "*why*" certain phenomena take place. This research study began with a problem statement and a set of research questions, of which the goal was to understand the complex world of learning using mobile devices from the learner's point of view and to provide greater understanding on mobile learning.

This project will benefit any education department, novice researchers, policy makers, implementers and educators conceptualising mobile learning from the learner's perspective, helping with the questions of:

- What is mobile learning?
- How is educational content taught through mobile technologies?
- How do learners experience and perceive mobile learning devices?
- How are the teachers supporting the mobile form of learning?

[4] Gregor (2006) distinguishes the five interrelated theories in the Information system as (1) theory of analysing, (2) theory of explaining, (3) theory of analysing, (4) theory of predicting and (5) theory of design and prediction.

This study will provide them with a greater understanding on how learners perceive mobile technologies in education and what needs to improve in order to enhance the mobile learning experience. Although the research questions seem to be relatively descriptive they do provide indication as to why things happen or what the impact is hence the findings of this case study confirm the philosophy of Gregor (2006) on the theory of explaining but nevertheless it is exploratory. The findings in this study presented and explained how learners in the case study experience and make use of mobile devices for learning purposes; the study also explored the learner's preferred activities and the purposes (why) of utilising mobile devices. Moreover, the study has provided ways on how teachers in the case study supports and motivates the learners.

The research outcome of this study illustrated that individual characteristics can affect and influence learners' experiences and that mobile devices are able to encourage and support the theory-based categories of learning; the findings indicated that mobile learning software supports learners when they collaborate with their fellow team mates, experts or anyone else, wherever and whenever they want to.

## 5.5 LESSONS LEARNED

Lessons learned resulting from this research project is summarised below:

| | |
|---|---|
| Device aspect (A) | Mobile devices are learning toolkit used in m-learning, the aim of m-learning is not to *replace* formal classroom learning but to *enhance* the classroom form of learning. Learners in the case study also indicated that the Edu-pad is just a tool used to enhance their learning experience, enabling them to access the learning content and to interact with their peers and teachers. Mobile devices are used inside and outside the classroom. Learning is depended on the physical characteristics of the device and on the input and output capabilities of the device. |

| | |
|---|---|
| Learner aspect (B) | Learners play an important role in the mobile learning process; they use their current knowledge to construct new ideas therefore, it is important to consider the individual learner as the key participant in the mobile learning process. Learners are confident and are used to utilising mobile devices in their daily activities. Teachers' role is to educate the learners thus it is important that they understand the learner's learning styles, their feelings, experiences and to provide the learning content suitable to their style. |
| Social aspect (B) | Mobile devices are used to socially interact, learners acquire knowledge through interaction.<br><br>Learners are encouraged to collaborate through various communication channels. The social aspect must be encouraged and controlled; mobile technology must be used purely for educational uses. |
| ABC | Active learning is enabled by the device, the Edu-pad is just a tool and the learners are the most important aspect of learning.<br><br>Teachers are empowered by the device to engage with the learners and to provide collaborative learning activities.<br><br>A routine should be established and proper procedure must be in place so that if breakdowns occur, there will be a quick and easy process to repair or replace the device. |

*Table 7: Lessons learned*

## 5.6 LIMITATIONS OF THE STUDY

During the course of this research study I was faced with several limitations; the following are the limitations that future researchers can address:

- The results of this research study cannot be generalised because the study concentrated on a single school with two teachers and fifteen learners in Grade eleven. The researcher recognises that there are a limited number of respondents nevertheless, this study was solely about voluntary participants of which two teachers and fifteen learners in grade eleven consented to participate. The objective of this study was to deepen the knowledge of mobile learning conceptualising the learner's perspective, to gain an in-depth understanding of the willing participants' behaviours at that particular school in order to interpret their actions as a single group. However, future researchers on similar research can extend the scope to a larger sample involving other schools that implement similar learning programs and can include the perceptions of the parents, principal and the government. Although it is not possible to generalise the results of this study, the findings however can be used as justification of the learner's preference, experience and attitude on mobile learning. Furthermore, the study provides an understanding on the teacher's perceptions and role in the mobile age.
- Testable predictions about the future was not the main objective of this study hence the study did not provide any predictions. The aim of the study was to provide explanations, primarily on how mobile technologies are being used as means to enhance teaching and learning in a privileged high school.
- Additional, this study did not pay any attention to the participant's socio-technological context, gender, race and ethnicity, all of which are important factors and should be investigated by future researchers. The goal of this study was not to analyse the data according to race or gender hence these factors were ignored.

## 5.7 RECOMMENDATIONS

The policy makers at government and educational management level (Curro, School governing body etc.) have a choice of whether or not to explore the capabilities of mobile devices for learning purposes. This research project attempted to demonstrate the opportunities offered by mobile learning devices and has provided practical examples on how learners in the case study experience and perceive mobile learning. This study has provided insights on the usefulness of mobile learning devices therefore the following recommendations are offered to support the effectiveness of mobile learning:

- Learners should be motivated to use mobile learning devices and encouraged to collaborate through various communication channels.
- Educators should provide learning activities suitable to the learner's learning styles and they should make the most of the learning curriculum that is entertaining nonetheless educational.
- Teachers must strive to provide instantaneous feedback, move towards "near real-time" response.

Recommendations derived from the research findings are:

1. The majority of the learners in the case study reported that they do not know which mobile application to download for game-based learning, this finding indicates that there are unclear concepts regarding game-based learning; that learners in the case are not well informed on utilising the game-base aspect of the mobile tool and that there's lack of support from the teachers on educational computer games. The literature review in chapter 2 discusses some of the significant functions of game-based learning; it is recommended for Northern Academy and other segments of Curro to consider integrating game-based learning in their curriculum. Before integrating a curriculum with games into the classroom, teachers' needs to map and identify the relationship between the embedded activities in the game and the learning context associated within those activities.

2. Learners in the case study reported that the Edu-pads are sometimes inconvenient to use because of the identified issues in Chapter 4 therefore, technical issues of the mobile tools should be taken into consideration and it should be of interest to Northern Academy to enhance the learners experience by resolving and minimising the identified issues.
3. As indicated in the scope and limitation section in chapter 1 that this study will not address the parents, principal and the government's perceptions; it is however advisable for the education sector to communicate and involve the parents or legal guardians of the learners before implementing the use of mobile tools at any school – to ensure that they understand the goals, practices and learning achievement of mobile learning.

## 5.8 FUTURE RESEARCH

Several issues have been identified in this research study, thought-provoking issues that can be explored for further investigation. Therefore it should be of interest for future researchers to consider researching mobile learning, to extend the literature and provide insightful details on what needs to be in place before putting mobile tools into practice and what will be the learning outcome of utilising mobile technologies for learning purposes. The section below will list the possible guidelines on how future researchers can extend the mobile learning literature.

Firstly, research on how mobile tools can be used to compliment learning and reinforce the current capabilities is needed, a study that will put more emphasis on the learning activities and outcomes.

Secondly, a detailed research that will focus on how teachers' support and motivate the learners, research that will put more emphasis on the teacher's role in the mobile age. As already mentioned teachers are only supporting learners in the classroom, they do not encourage game-based learning and digital storytelling. It is obvious that further research is needed on how teachers can support learners in using mobile technology inside and outside the classroom. Teachers play a vital role in the mobile learning process and it is important that they recognise the value of computer games or certain types of games and enhance their teaching styles to cater for the digital natives.

Lastly, the findings in this research study did not demonstrate a relationship between mobile learning and learner's achievement, it is recommended for future researchers to establish the link between mobile learning and learner's achievement in order to determine the accomplishment of learning using mobile tools.

## 5.9 CONCLUSION

This study utilizes a qualitative research approach to discover and understand how mobile learning is being used at that particular school. The interpretivist paradigm was used to personally understand the perspective of the participants (the lived experience of learners in mobile learning) in that context. Data was gathered through face to face unstructured interviews with two teachers and fifteen learners in grade eleven.

The interactive whiteboard and the Edu-pads were introduced at Northern Academy to support the current learning methods. The device usability aspect of the Edu-pads empowers learning beyond the classroom, enabling the learners to move around with the device to any location suitable for learning. The interactive whiteboard enables the teacher to display the learning content to the learners providing a wide display; diagrams can be animated and interactive; the tool adds good value to the classroom activity facilitating visual and collaborative learning. The research findings indicate that the teachers support the learners to use their current knowledge to construct new ideas.

The technologies used at this particular school allow the teachers and the learners to share learning resources and communicate with each other, however this study has illustrated that there is a lack of support from the teachers for educational computer games and that learners are unable to communicate with their teachers using this technology outside the classroom - communication with the teachers occurs only inside the classroom.

According to Koole (2009) in her FRAME model, learners play an important role in the mobile learning process thus it is important that

- Learners are fully supported by their educators in the learning process; the learners are the most important aspect of learning.

- The device aspect must enable learning to occur at anytime, at any location.
- The social aspect must be encouraged and controlled; mobile technology must be used purely for educational uses.

Mobile tools indeed has the potential to enhance learning and teaching but it is important to remember that the digital tools will not transform the education sector simply by introducing the tool, there are critical steps that needs to be taken into consideration before introducing mobile tools. An assessment is needed to evaluate the existing circumstance, a clear understanding of how the mobile tools will enhance or empower the individual capabilities, a proper strategy that will cater for the technical issues, monitoring plan for measuring the success or failure of the tool and training plan for equipping the teachers with the necessary skills for supporting Generation Y learners. It is also important to have knowledge of the affordances and constraints of that technology; to understand how learning using mobile technologies affects the learners and what needs to be done to support the learners. As already mentioned, mobile technologies evolves rapidly therefore existing hardware, applications and even teaching techniques can be superseded hence there will be a need for replacement with the associated tools, on-going training and research within the school.

Technology-rich learning activities empowers high level of student involvement and collaborative learning therefore, educators need to make sure that they take full advantage of mobile platforms to enhance educational learning. Mobile tools are likely to enhance teaching and learning when deployed suitably to meet and support the learner's learning styles. Learners come from diverse backgrounds, have different characteristics affecting and influencing their learning styles; mobile learning enables individuals to personalise the learning content based on their preferences, providing a holistic learning experience relevant to the learners' unique interest.

This study has presented the possible uses and content that can be taught through digital technology and we can conclude from the research findings that mobile tools can be used to enhance learning; to empower learners wherever and whenever they are to be effective therefore, the role of mobile technologies in schools should not be underestimated.

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# 7. LIST OF APPENDICES

## 7.1 Appendix A: Unstructured research questions

RQ1: What educational content can be taught through mobile technologies?

| Unstructured interview questions for the teachers |
| --- |
| – Which mobile tools are being integrated into learning at your school?<br>– What content is being learned or taught through mobile technologies at your school?<br>– How are mobile devices utilized at your school? Who uses mobile devices?<br>– What are the features and applications on the mobile tools used for learning by the learners and the teachers at your school? |

RQ2: How are the teachers supporting the mobile form of learning?

| Unstructured interview questions for the teachers | |
|---|---|
| Why mobile learning? | – When was mobile learning introduced at your school?<br>– What prompted the decision to use mobile learning at your school?<br>– What makes mobile learning different from other learning modes?<br>– Do you foresee any future addition or new uses beyond what is currently adopted? |
| Benefits and uses | – What kind of training is offered to learners on the use of mobile technologies for learning?<br>– How will learning using mobile tools benefit the learners? |
| Communication and Engagement | – How are you engaging with learners using mobile tools?<br>– How are you encouraging learners in using mobile tools? |

RQ3: How do learners in the case study experience and perceive mobile devices for educational purposes?

| Category | Unstructured interview questions for the learners |
|---|---|
| Experience | – Do you know how to appropriately use mobile devices as learning tools?<br>– What do like about learning using mobile technologies and why? |
| Perception | – What are your perceptions about using mobile technologies for learning purposes for your school work?<br>– Do you perceive mobile tools as a means to enhance learning?<br>– What factors do you identify as influencing your use on mobile leaning? |
| Preference | – What learning activities do you mostly use?<br>– Do you prefer learning using mobile tools as opposed to learning without mobile tools? Why? |
| Routine | – How often do you use mobile devices for educational purposes?<br>– What prompts you to use mobile technologies? |

## 7.2 Appendix B: Related documents

### 7.2.1 Ethical consent letter from Northern Academy

NORTHERN Academy

Good Day Mrs Corne

Thank you for your time over the phone. As discussed, my name is Agnes Hlagala a 2004 matric graduate at Northern Academy. I am writing to request permission to conduct a research study at Northern Academy Secondary school. I am currently enrolled at UNISA Florida Campus and am in the process of writing my Master's Thesis.

I hope you will allow me to interview two teachers and fifteen learners in grade 11 from the school to anonymously take part in the unstructured interview. The interviews will take place after school hours at the participants' recommended time and place in the school premise.

Interested teachers and learners, who volunteer to participate, will be given a consent form to be signed by their parent or guardian (copy enclosed). The interview process should take no longer than 40 minutes, please find attached the unstructured interview questions. No costs will be incurred by either your school or the individual participants.

Your approval to conduct this study will be greatly appreciated. I would be happy to answer any questions or concerns that you may have. You may contact me at: hlagal_a@mtn.co.za / 0832120621.

If you agree, kindly copy the contents of this email to your institution's letterhead acknowledging your consent and permission for me to conduct this study at your institution. Please sign and stamp the letter.

Thank you kindly.

Regards, Agnes Hlagala

**Approved by:**

Sharon Cortzee Teacher | Signature | 29-9-2014

Print your name and title here | Signature | Date

NORTHERN ACADEMY 29 -09- 2014 PIETERSBURG 0700

managed by CURRO

Mobile educational technologies currently used as a means to enhance teaching and learning in a privileged high school.

Author: AR HLAGALA

### 7.2.2 Ethical clearance from UNISA

UNISA college of science, engineering and technology

Miss Agnes Ramasesele Hlagala (50814338) 2014-10-12
College of Science, Engineering and Technology
UNISA
Johannesburg

**Permission to conduct research project**

**Ref: 184/ARH/2014**

The request for ethical approval for your MTech (Information Technology) research project entitled "Mobile educational technologies currently used as a means to enhance teaching and learning in a privileged secondary school" refers.

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (CREC) has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:
http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Please note that if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

Prof Ernest Mnkandla
Chair: College of Science, Engineering and Technology Ethics Sub-Committee

University of South Africa
College of Science, Engineering and Technology
The Science Campus
C/o Christiaan de Wet Road and Pioneer Avenue
Florida Park, Roodepoort
Private Bag X6, Florida, 1710
www.unisa.ac.za/cset

UNISA college of science, engineering and technology

Mobile educational technologies currently used as a means to enhance teaching and learning in a privileged high school.

Author: AR HLAGALA

### 7.2.3 Consent form for research participants

**CONSENT FORM FOR RESEARCH PARTICIPANTS**

Thank you for agreeing to participate in this research study. I, Agnes Hlagala have obtained permission from the school by the principal to conduct the interview. The interview will take 40 minutes. This consent form is to be signed by learners above 18 years old or by the parent or guardian of learners who are under 18. This form details the purpose of this study and your rights as a participant.

**Research title:** Mobile educational technologies currently used as a means to enhance teaching and learning in a privileged primary school

**Purpose of the Study is:**

- To understand how mobile technologies are currently being used in education and what content could be learned through mobile technologies.
- To understand the individual characteristics affecting and influencing learners, their lived experiences on using mobile tools for learning and how their behaviors are influenced by their thoughts, feelings and principles.
- To understand the educator's role in the mobile age, how are they supporting the learners in learning using mobile tools?

**Method that will be used**: Face to face unstructured interviews.

| **Your rights as a participant** |
|---|
| You are encouraged to ask questions or raise concerns at any time of the interview. |
| You are free to withdraw from the research at any time without any negative or undesirable consequences. |
| The interview is scheduled to take 40 minutes should the time be exceeded; you have a right to end the meeting. |
| With your permission, interviews will be audio recorded and the responses will be treated in a confidential manner. |

**Regards,**
**Agnes Hlagala**

1

Mobile educational technologies currently used as a means to enhance teaching and learning in a privileged high school.

Author: AR HLAGALA