

UNIVERSITY OF KWAZULU-NATAL

**The use of Mobile Technology Devices in Botswana Secondary Schools to enhance
Teaching and Learning**

By

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DECLARATION

This study is the original work of the author and has not been previously accepted for any degree and is not being currently considered for any other degree at any other university.

I declare that this dissertation contains my own work except where specifically acknowledged.

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Signed.....

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GLOSSARY OF TERMS

In the context of this study, broad meanings that I attached to core concepts are as follows:

- 1. Mobile device:** A computing device small enough to hold and operate in the hand. Typically, any handheld computer device will have an LCD flat screen interface, providing a touchscreen interface with digital buttons and keyboard or physical buttons along with a physical keyboard.
- 2. Smartphone:** A mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, internet access and an operating system capable of running downloaded apps.
- 3. Botswana:** Officially the Republic of Botswana (Tswana: Lefatshe la Botswana), a landlocked country located in Southern Africa. The citizens refer to themselves as Batswana (singular: Motswana).
- 4. Learning:** The acquisition of knowledge or skills through study, experience or being taught.
- 5. Enhance:** Intensify, increase or further improve the quality, value or extent of.
- 6. Teaching:** The occupation, profession or work of a teacher.
- 7. Academic performance:** The outcome of education – the extent to which a learner, teacher or institution has achieved their educational goals.
- 8. M-learning:** Learning across multiple contexts, through social and content interactions, using personal electronic devices.
- 9. Web 2.0:** The current state of the internet, characterized by greater user interaction, mobility, social networking and website interactivity, in contrast to the more static nature of the early World Wide Web (WWW)

LIST OF ABBREVIATIONS

ICT	Information and communication technology
IT	Information technology
RNPE	Revised National Educational Policy
SMS	Short message service
SPSS	Statistical Package for Social Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organization

ABSTRACT

Traditionally learning was transmission of knowledge from the teacher to the learner, but today, it is a two-way process where both the teacher and the learner are involved. Mobile technology devices have taken the world by storm. Many people own a mobile technology device, and these devices are now also used in teaching and learning. Different learning methodologies have been used in teaching and learning; however, results have not improved as was expected. This study examines an intervention where some learners were allowed to use their smartphones in their teaching and learning. The purpose of this study was to investigate whether mobile technology devices (smartphones) can be used to enhance teaching and learning in secondary schools in Botswana. This study employed a mixed-methods (qualitative and quantitative) design. Purposive sampling was used to select the sample for the study of 75 respondents. The findings recommend that mobile technology devices (smartphones) should be allowed in classroom teaching and learning and should be incorporated into the school's curriculum, since the results of this study showed that smartphones do to some extent enhance teaching and learning and thus improve academic performance.

Keywords: *smartphones, learning, education, teaching, technology, web 2.0, activity theory, school education*

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CHAPTER ONE: INTRODUCTION TO THE STUDY

1.1 Introduction

Computers and mobile technologies have been used for some time, and today smartphone use is pervasive. This is supported by Nleya and Mokgoare (2014) who say that mobile phone ownership in Africa is booming, and is transforming everything from banking and healthcare to agriculture and politics. Several projects exploring the use of mobile devices to facilitate learning throughout Africa have been conducted. For example, in South Africa, Radical Learning developed a product that provides teachers with daily lesson plans in Mathematics and Literacy from Grade R to Grade 3, as well as a weekly homework activity schedule for parents to stay up to date on their children's schoolwork (Graham, 2012). The Road to Reading programme in Mali and the Information Technology project in Tanzania show how mobile phones can act as conduits for the delivery of curriculum-centred video content within a classroom setting. The contents of these programmes are accessible via internet-enabled mobile phones. Mobile devices have been used for different reasons in education, but smartphone use in teaching and learning has not yet been studied. For this reason the researcher wished to explore how mobile technologies (smartphones) can be used to enhance teaching and learning. With the power of portable computing being so accessible, the time has come to consider using mobile technologies in education to enhance teaching and learning.

The goals of the Revised National Educational Policy (RNPE) of Botswana (1994) are to prepare Botswana for the transition from a traditional agro-based economy to the industrial economy that the country aspires to. One of the overall objectives of the RNPE of 1994 reads as follows: "To emphasize science and technology in the education system" (Republic of Botswana, 1994, p. 5).

The Government of Botswana has introduced computer studies in junior and senior secondary schools, and has equipped almost all computer labs with state-of-the-art computers and resources. The above objective has been achieved by integrating information and communication technology (ICT) tools and resources in the education sector, where it was emphasized that teachers and facilitators should start using them. This has not changed academic performance nor enhanced teaching and learning since its inception because teachers, facilitators and other education stakeholders have been reluctant to use technology in teaching (Botswana Examination Council, 2011).

The Botswana national ICT policy (2007, p. 3) states that:

Over the coming years, Botswana must become a nation that maximizes the power, reach, versatility and innovation of ICT. This will enable the country to secure a key position in the emerging global information society, and flourish economically throughout the new millennium. As a result, a primary focus of the Policy is the development of ICT-related skills in children and young adults. It will be this segment of society that benefits most from increased levels of connectivity, and it will be their ICT skills and expertise that chart a new and exciting course for our country.

Even though this has been the case, these policies have not been taken into consideration to improve education in the country. It is widely acknowledged that imparting knowledge to the learners through mobile technology devices may lead to great opportunities for teaching and learning (United Nations Educational, Scientific and Cultural Organization [UNESCO, 2012a]). Computers have been used in almost every industry in the country. They have been used in the education sector, as seen by the two policies discussed above, but results have not changed. The time is right to use mobile technology devices/smartphones to enhance teaching and learning. Knowledge can be acquired from anywhere using smartphones; this means learning goes beyond formal classroom contact to informal classroom contact where learners will be able to assimilate the content learnt in class on their own.

1.2 Purpose of the study

The purpose of this study was to investigate if mobile technology devices (smartphones) can be used to enhance teaching and learning. The study aimed to determine if there is a correlation between the uses of mobile technology devices and learning, how mobile technologies can be used to enhance teaching and learning, and which Web 2.0 tools together with mobile technology are more appropriate to enhance teaching and learning in Botswana secondary schools.

1.3 Problem statement

The Ministry of Education and Skills Development of Botswana aims to deliver quality education for all across the country. Almost all junior and senior secondary schools in Botswana have furnished and up-to-date Computer Education labs, with adequate access to the internet and all of the required software for learning. This meets one of the objectives of the RNPE, which is “to emphasize science and technology in the education system” (Republic of Botswana, 1994, p. 5). Efforts have been made by teaching service management to integrate and use ICT tools in the delivery of the teaching and learning process. The Government of Botswana through the Ministry of Education and Skills Development has also expanded both the required infrastructure and services to give every child, from basic education to tertiary level, an opportunity to access free education and the use of computers with internet services in learning. This includes the curriculum documents being reviewed and channelling them in line with the ICT component by introducing Computer Education at all levels. Setting up computer laboratories in almost all secondary schools has been another drive to help the teaching and learning process. Refurbishment of old computers for distribution to primary schools as well as making sure that all secondary schools are connected to broadband internet resources and increased access to ICT resources at community level has been seen as one of the key strategies to help in the education sector.

Teachers and education providers and personnel in the Ministry of Education and Skills Development have been blamed for the poor academic performance of learners over the years, at primary, junior and senior secondary schools. New projects emanating from the national ICT policy and initiatives have been put into place to help enhance teaching and learning, to improve and increase the annual academic results of learners. None of this has had any impact. Different types of learning have been tried and tested as a remedy to enhance teaching and learning. Traditional methods of teaching have been supplemented with computer-based education and still the academic performance of learners has not improved. This has left academic life in Botswana the same, continuing to decline over the years, as shown in Table 1.1, which shows how the performance of candidates changed over the last five years. This table also shows the total number of grades obtained by all candidates in all syllabi, with the cumulative percentage (Cum) computed at each grade. It shows that in 2015, of all the grades awarded, 27.27% are C or better. There is a slight increase in performance for grades C or better of about 1.52% from the previous year: 2014 – 25.75%, 2013 – 27.91%, 2012 – 28.82%, 2011 – 30.86% (Botswana Examinations Council, 2015).

Table 1.1: Performance at each grade since 2011

Grades Awarded	Grade A*		Grade A		Grade B		Grade C		Grade D		Grade E		Grade F		Grade G		Grade U	
	No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %
2015 255245	1439	0.56	4192	2.21	18781	9.56	45196	27.27	53669	48.30	54163	69.52	39613	85.04	27906	95.97	10286	100
2014 251451	1458	0.58	4338	2.31	16930	9.04	42027	25.75	54186	47.30	54057	68.80	40056	84.73	28334	96.00	10065	100
2013 240123	1376	0.57	4818	2.58	18618	10.33	42198	27.91	52953	49.96	49208	70.45	38185	86.35	25319	96.90	7448	100
2012 225375	1355	0.60	4339	2.53	17047	10.09	42204	28.82	51173	51.52	49692	73.57	37223	90.09	16814	97.55	5529	100
2011 211,618	1,881	0.89	4,559	3.04	18,098	11.60	40,765	30.86	49,036	54.03	45,292	75.43	31,060	90.11	14,581	97.00	6,346	100

Source: Botswana Examinations Council (2015)

1.4 Rationale for the study

The rationale for the study was that there is low performance of learners in terms of their results in Botswana's senior schools every year, as the results continue to drop. Teachers use mobile

technology devices for therapy or leisure activities, through Web 2.0 technologies. Learners in both urban and rural areas of Botswana can afford to use mobile devices from their location, and mobile technology devices allow them to access the internet at little cost from the internet service providers. Children have access to mobile devices and they use them for various purposes, including playing games, online and live chats with their peers, and many more. They are familiar with their use and can communicate interactively with others from different locations. Given the aforementioned and the curiosity about using mobile technology devices among both teachers and learners, these can be used to advantage, and used in teaching and learning to determine whether the use of smartphones can enhance teaching and learning.

1.5 Objective of the study

The objective of the study was to determine whether use of smartphones in the classroom can enhance teaching and learning in Botswana secondary schools. Mobile devices have been used in teaching and learning and can support teachers and instruction in a growing number of ways. They can be used to create content (Hartnell-Young & Vetere, 2008), for learner-centred learning, one-on-one collaboration (Corbeil & Valdés-Corbeil, 2007), reliable learning (Brown & Duguid, 1996), and variation of instruction (Kukulska-Hulme, 2007), as well as for assessment (Markett, Sanchez, Weber, & Tangney, 2006). Additionally, the portability of mobile devices allows anywhere/anytime access to course material for both teachers and learners.

The objective of the study was to provide the learners, educators, curriculum developers and parents with a new solution or idea that they can adopt to enhance teaching and learning in Botswanan secondary schools, with a concomitant improvement in results.

1.6 Theoretical and conceptual framework

The theoretical framework for this study is activity theory, which is a theoretical framework for analysis and understanding human interaction through the use of tools and artefacts. It uses the whole work activity as the unit of analysis, where the activity is broken into the analytical components of subject, tool and object. The subject is the person being studied, the object is the intended activity, and the tool is the mediating device through which the action is executed (Hasan, 1998). The positivism paradigm was chosen for this study, as it enabled investigation of whether the use of mobile technologies (smartphones) can enhance teaching and learning.

1.7 Research questions

This study was guided by the following research questions:

1. Which Web 2.0 tools are being used with smartphones for teaching and learning?
2. For what purposes are Web 2.0 tools being used with smartphones in the classroom?
3. How does the use of smartphones affect teaching and learning?
4. How can Web 2.0 tools be used with smartphones to enhance teaching and learning?

1.8 Research methodology and design

1.8.1 Research methodology

This study used both quantitative and qualitative research methods (a mixed-method approach) because quantitative research looks at relationships between variables and can establish cause and effect in highly controlled circumstances – hence its use in this study. Quantitative research is numerical representation and manipulation of observations for the purpose of describing and explaining the phenomena that those observations reflect. In addition, according to Cohen and Manion (1980) quantitative research is defined as social research that employs empirical methods and statements, while a qualitative approach seeks to gather an in-depth understanding

of human behaviour and the reasons that govern such behaviour, as in this study. The use of a mixed-methods approach ensured that there were no ‘gaps’ in the data collected.

This study employed an intervention in which there was a control group that was subjected to traditional methods of teaching, and a test group that used mobile technology devices in teaching and learning. The control and experimental groups were in different schools and no group was aware that it was either a control or a test group. This was a blind study because no group was aware what was happening with the other group. The data were collected for a period of one school term. The results from the two groups guided and helped to answer the research questions under study.

1.8.2 Context and sampling

The sample was made up of 75 learners from two selected senior secondary schools. This was a case study since the researcher only used a limited number of schools. The participants were Form 4 and Form 5 learners. Purposive sampling was used to select participants for the study. This is supported by Tashakkori and Teddlie (2003, p. 713), who stated that “purposive sampling techniques involve selecting certain units or cases based on a specific purpose rather than randomly”.

1.8.3 Methods of data collection

A quantitative questionnaire, focus group interviews and an intervention using smartphones in teaching and learning were used to collect data and strengthen the aims of the study. Focus group interviews were conducted with the test group who used smartphones in their teaching and learning to get their perceptions on their use of smartphones in teaching and learning. The questionnaire, focus group interviews and an intervention using smartphones for teaching and learning helped the researcher to answer the research questions under study.

1.8.4 Data analysis and interpretation

The data from the questionnaire and the focus group interviews was grouped according to type of questions. The data were entered and analysed using the Statistical Package for Social Sciences (SPSS). The test results for both groups, the control and the test group, were compared to determine if mobile technology devices can enhance teaching and learning or not. Data were analysed using tables and charts from SPSS. The descriptive data from the interview were recorded using a tape recorder and later transcribed into text in a notebook. Similar responses were then grouped together to make the analysis easier. The tapes and notes were reviewed frequently, writing down direct quotes that were deemed relevant. Daily interpretative analysis was used to analyse the interview data; at the end of every day of interviewing the interview data were reviewed and a report was written to summarise and interpret the information obtained.

1.8.5 Ensuring trustworthiness of the study

A pilot test was done in the two selected schools in the south inspectorial region of Botswana to show reliability. The questionnaire was piloted with 10 learners and necessary changes were made. The questionnaire used in the study was adopted from that of Wali (2008) on 'Reinterpreting Mobile Learning: An Activity Theoretic Analysis of the Use of Portable Devices in Higher Education'. Appointments were made with teachers and learners to pilot the questionnaire, and a mobile technology application was chosen which was used for a period of two weeks during the pilot. This enabled teachers and learners to gain an understanding and appreciation of the purpose of the study

Trustworthiness was considered, as well as transferability and auditability, to deal with issues of rigour. Reliability of the study was assured through:

- The use of prolonged data collection; and

- Theoretical verification – where the findings of the study are compared to the results of previous studies.

1.8.6 Ethical issues

Before the data collection could start the researcher sought and received approval to conduct the study (see Appendices IX and X). All participants who were interested in taking part in the study were accepted, and those who wished to leave the study were free to do so. No one was forced to take part in the study without their consent. No learners below the age of 18 years were allowed to participate without their parents' or guardians' consent. All data provided during data collection were treated confidentially and no names were or will be revealed to anyone. Letters of consent were sent to parents/guardians to sign to allow their children below 18 years of age to take part in the study (see Appendices III to VII).

1.9 Structure of the study

This study consists of six chapters, as outlined below:

Chapter One introduces the study and presents the purpose of the study, problem statement, rationale for the study, objective of the study, theoretical and conceptual framework, key research questions and the research design and methodology.

Chapter Two discusses related literature which supports the study: the existing literature on the use of mobile technology devices (smartphones) in teaching and learning and their impact on education.

Chapter Three discusses the theoretical framework of the study.

Chapter Four sets out the research methods used to answer the research questions under study. It also discusses the research context, research methodologies, timeframe for data collection, data collection instruments, ethical considerations and limitations of the study.

Chapter Five presents an analysis of the results on using mobile technology devices (smartphones) in teaching and learning, with support from the literature review.

Chapter Six provides the conclusion, implications and recommendations of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter discusses the existing literature on the use of mobile technology devices (smartphones) in teaching and learning and their impact on education. The following sections are discussed; Review of the revised national policy on education, forms of learning using mobile technology devices, the role of mobile technologies (smartphones) in supporting teaching and learning, mobile technology learning applications, types of learning, internet access and use among young people, household access to internet in Botswana, cell phone use in Botswana, household access to a computer in Botswana, the use of mobile technologies in teaching and learning, and smartphone ownership in Botswana.

It is widely acknowledged that implementing mobile learning via mobile technologies may lead to greater opportunities in teaching and learning (UNESCO, 2012a). A UNESCO paper states that “with mobile technologies, by far the most universal interactive information and communications technology on earth which can be used to deliver and improve education, they carry a remarkable potential to assist learning everywhere” (UNESCO, 2012b, p. 6). However, DeWitte (2010, p. 45) contests that “learning with mobile devices has not been thoroughly researched”, while Brown (2005) cited in DeWitte (2010, p. 45) states that learners wish to carry their cell phones to school, and to be allowed to use them for learning purposes. Using cell phone technology as a tool to research, organise, evaluate and communicate has become a 21st century skill (Birch, 2012). Birch (2012, p. 1) also stated that “mobile learning, integrating cell phone technology into the classroom, would increase learner achievement and engagement as well as revolutionize instruction”.

The development and adoption of mobile technologies has left educators with no choice but to explore innovations in the teaching and learning environments (Brown, 2005). According to

UNESCO (2012c) there are more than seven billion people on the planet, and more than five billion of them have mobile phone subscriptions. The potential for mobile technology to make contributions to education is high, with the ability to offer versatility and convergence (Wallace, 2012). Firstly, mobile phones are small, making them easy to carry. Other devices such as laptops require a backpack and the physical ability to carry them around. Mobile phones can therefore be used anywhere and at any time, such as while on the bus, between classes, in a queue or on the playground. This means that if used appropriately they can enhance teaching and learning, and thus improve academic performance. The physical boundaries of the classroom and time for learning no longer prevail because the content from smartphones is ubiquitous. Learners can communicate with teachers, other learners and anyone else to satisfy their need for knowledge using the new generation of mobile devices – digital media players (including iPods and iPod Touches), smartphones (including iPhones, Android phones, BlackBerrys and Windows phones), personal digital assistants and tablet computers (including iPads). Many studies have explored the use of mobile devices in education, however, the focus on smartphones is minimal. Therefore there is a need to determine the use of and possibilities for smartphones to influence teaching and learning, which is the purpose of this study.

Technology has taken the world by storm. Almost everything is done using technology today. This is supported by Eteokleous and Ktoridou (2009), who agree that as technology advances, mobile technologies and their applications have brought about opportunities in the world in which people live, making it possible effectively to do almost everything with the device in the palm of one's hand. Teachers and learners have access to mobile technology devices and the internet; this can be used to advantage, and used in the education sector as a way of improving the education system. Using mobile technology devices enables the learner and the facilitator to interact and communicate using applications embedded in these devices. These can help in reminding learners about important announcement or tests if the facilitator is not in class.

Learners can be reminded of their education and they can take control of it 24-hours a day. This is active learning, because the learner will be involved in the teaching and learning process. The Web 2.0 and tools such as WhatsApp, Facebook, Twitter, Instagram and many others which come with mobile technology devices, have features which keep one busy with them. Some of these features can be taken advantage of and used in teaching and learning, to benefit and improve the education of learners.

Learning involves the teacher or facilitator and the learner being actively involved. It is a shared experience, because learners explore new ideas and knowledge while being steered by their teachers who impart knowledge to them. This knowledge is what will shape what learners will do in real life, after they have assimilated it. There are different types of learning; however, for the purposes of this study we will focus on learning using mobile devices, which is also called e-learning. The majority of mobile-learning research conducted in secondary school education focuses on the question of whether adolescents have the intrinsic motivation to succeed in independent learning environments, looking at the fact that there are high numbers of dropouts (Chalabaey, Major, Sarrazin & Curry, 2012). A few studies have attempted to focus on supplementing traditional teaching methods with mobile learning and a focus in Botswana was omitted, hence the keenness to conduct this study.

2.2 Review of the Revised National Policy on Education

“Education is the greatest engine for personal development, it is through education that the son of a peasant farmer becomes a president, and it is through education that the daughter of a maid becomes a doctor.”– Nelson R Mandela.

Any country has to achieve sustainable development through education; without education the country will be doomed. That is why the Government of Botswana produced the Revised National Policy on Education of 1994. The Revised National Policy on Education Government

Paper No. 2 of April 1994 has been the guiding basis for the implementation of providing quality education and training to Botswana and its citizens. It has guided the programme activities of the Ministry of Education and Skills Development in terms of curriculum reforms and on-going improvements in the education sector. The implementation of the RNPE in 1994 was intended to cover a timeframe of 25 years, given that its recommendations had been classified for implementation in the short, medium and long term (Botswana Federation of Trade Unions, March 2007). Like most modern nations, the formal education system in Botswana is from preschool to tertiary level. The RNPE Government policy released in 1994 highlighted the need for all learners to be taught computer and ICT skills at all levels of education across the nation. This gave birth to the introduction of Computer Education courses in junior and senior secondary schools. Computer Education is taught as a core subject in junior schools but it is not examinable, unlike in senior secondary schools where it is an examinable subject and learners choose it as an option relative to Home Economics, Business Studies and Christian Religious Education.

The Computer Education curriculum aims to equip learners with computer skills that can be applied in all subjects in their future, as technology has transformed the way people live. There are different ICT policies which supported the introduction of Computer Education in the Botswana education system. These include the national ICT policy and the Maitlamo policy (Government of Botswana, December 2004) which supports the fact that everyone needs to have access to ICT to make Botswana a better place to live and work, and a better place to enjoy. Botswana's national ICT policy incorporates a dedicated section on education, with clear, ambitious targets to be reached by the end of 2010. This study takes all of the aforesaid into consideration and takes advantage of the use of mobile technology devices – smartphones – to investigate if they can be used to enhance teaching and learning.

2.3 Forms of learning using mobile technology devices

2.3.1 Blended learning

This includes two methods of learning, a traditional method of learning and learning using mobile devices. In blended learning technology supports a change in pedagogical ways and helps learners within and outside the class. The traditional method of learning takes place through formal contacts in the classroom (Arnab, Lim, Carvalho, Bellotti, Freitas, Louchart, Suttie and De Gloria, 2015).

2.3.2 Computer-based training

This is where learners' learning is supported by the use of computers, where they rely mostly on the computers for information. The computer is fed with instructions and educational learning content which the learner has to access by logging on and downloading the content (Pilli & Aksu, 2013). Eldridge, (2000, p. 23) defined computer-based learning as "simply another means of delivering good quality training".

2.3.3 Web-based training

This is done through the internet using some software, a web browser. This includes streamed videos, which will be downloaded and viewed at the learners' own time and at their own space, audio recordings which contain playbacks of classroom lectures, and online chats where there will be two-way communication between the lecture and the learner with instant and interactive responses (Wright, Lopes, Montgomerie, Reju & Schmoller, 2014). Since the 1990s, Web-based education has been seen as an important branch of learning using technological means. It provides learners with access to information and knowledge sources that are practically unlimited, enabling personalised learning, tele-learning, distance learning, and collaboration (Brusilovsky, 1999).

2.3.4 Virtual learning environments

These use software in a virtual world to enhance teaching and learning. Learners and lecturers or facilitators need to have access to a computer and the internet so that they can open this software in the virtual world or online, so that learning can continue. The virtual learning environment helps to manage knowledge, tracking of learners and online support for learners and teachers through online learning or communication. Learners and their teachers interact in the virtual learning environment through logins designated for them to use the software of their choice, like Google Classroom, WebCT, ITS, Moodle and Blackboard (Sclater, 2008).

The Government of Botswana and other stakeholders such as UNESCO have made great efforts to support education by piloting the implementation of ICT tools in schools and learning environments in Botswana. Even though that is the case, the education system has still not improved, even though almost everyone has access to the internet and a mobile technology device. It is vital for learners to use these mobile devices in education now, in order to try to improve academic performance and enhance teaching and learning. Many electronic learning platforms such as WebCT, Blackboard, Google Classroom and many others have been designed and introduced to support teaching and learning. This electronic learning platform creates a virtual world of learning between the facilitator and the learner who may be in different places. That said, it has not been proven beyond reasonable doubt that e-learning via these platforms can bring about academic improvement.

2.3.5 Learner Acceptance/ Preferences

A study by Dewstow and Wright (2005) showed that a handful of studies have asked learners about their preferences towards certain aspects of their online courses. The responses suggest that high school learners often struggle with issues related to technology and isolated learning, but enjoy the autonomy provided by online instruction. If the learners can be oriented on the

use of mobile devices with e-learning platforms at an early stage, before they commence their studies, then something can be achieved. This is supported by the research carried out by Warschauer (2011), investigating the use of iPads in K-12 schools in the United States of America. This study made the observation that in one private school in California learners had daily access to laptops and frequent access to iPads, thus allowing the researchers to compare the use of the two. Warschauer (2011) noted that learners in a Science class preferred using the iPads to the laptops due to their light weight, mobility, touchscreen, and simple and easy applications. With mobile technologies and smartphones put into place, learning will never stop – it will be continuous with no time limit; that is, learners will be able to have access to learning materials 24 hours a day. This means learners learn on their own terms, with no fear of intimidation from their colleagues and peers.

Electronic learning platforms are more reliable and dependable, as they allow learners to download course content and material to be used offline. They also allow online and live chats where the learners, facilitators and tutors will be able to engage interactively online. This also allows facilitators to post announcements, quizzes, assignments and test marks for learners to view in their own time. If used effectively in education, mobile technology devices and tools are seen as being able to enhance teaching and learning of learners in Africa and the world. They can also be used as teacher guides, since learners are able to communicate with each other during informal contact to get views and ideas of what transpired during the classes. Learners can also view and download educational materials online, ask relevant questions and get appropriate answers online.

Mobile technology devices are very flexible because they are lightweight, which means that people can carry them around and use them in different settings. These sentiments are supported by Stone, Lynch and Poole (2003) and Whattananarong (2005), who concluded that

the mobile phone's portability, simplicity and affordability make it a natural fit for education initiatives in places where personal computers and internet connectivity may be scarce.

Kumar et al. (2010) argued that mobile devices like cell phones are the perfect vehicle for making educational opportunities accessible to rural children in places and at times that are more convenient than formal schooling. Mobile technology devices allow the learners to form learning groups in their chosen application, and to collaborate with each other and discuss education matters; thus learning is involved. Parents have also allowed their children to use mobile technology devices, and make sure that their children have access to a mobile device of their own choice, buying their children these devices. According to Becta (2004) the use of wireless technologies results in parents' increased involvement in education and their increased knowledge of their children's learning and capabilities in learning, which enhances learning and can help improve academic performance. Learners using mobile devices can benefit in a number of ways over those using traditional teaching and learning methods, for example note-taking, recording experiments during classes, recording audios of teachers in classes and having playbacks during their own time (which is also considered as repeating the lesson), reading e-books and many more. All these can be taken home to continue working on them with the assistance of parents and relatives; the learners are also able to communicate with their peers online and be part of the virtual classroom.

A study by Vahey and Crawford (2003) concluded that teachers reported that learners using handheld wireless technologies demonstrated an increased autonomy in learning, as learners show increased self-directedness in learning and take the initiative in finding ways to use the handheld devices for learning. This was reported to have improved their learning enormously. The results from such studies support the concept of using mobile technology devices in the education of learners, since fruitful results have been observed. The literature discussed shows

that the world is beginning to take the use of mobile devices in teaching and learning as a serious remedy for enhancing teaching and learning and improving academic performance results.

One may argue that the correct way to start using and assimilating mobile devices into teaching and learning is to train learners and facilitators on the effective use of mobile devices in education. A mixed-method approach with an experimental design was conducted to determine if the use of mobile technology devices (smartphones) can enhance teaching and learning in Botswanan secondary schools.

2.4 The role of mobile technologies (smartphones) in supporting teaching and learning

Many studies have shown that mobile technology devices can support teaching and learning in a number of ways. According to Nortcliffe, Middleton and Woodcock (2011) Web 2.0 technology tools and applications can facilitate learners' learning by interacting collaboratively anytime and anywhere. This means that learning never stops: it is a process that takes place 24 hours a day, with no time limit. Liaw, Hatala and Huang (2010) reported that mobile phones used in education can be used to provide course materials to learners, including due dates for assignments, and information about timetables and room changes. Cui and Wang (2008) found out that in China learners can view their teachers' comments and test scripts and feedback via mobile technology devices or smartphones. This is supported by a study by UNESCO (2012b), which has shown that mobile-learning projects in South Africa have been proved a success in improving teaching, and especially in teaching Science subjects.

In support of the above, Thornton and Houser (2005) concluded that mobile phones were used by learners for communicating with lecturers in charge of the course materials and to collect data, sending emails to lecturers, accessing the Online Public Access Catalogue and sharing

resources provided by their teachers and facilitators. Learners were able to submit their assignments and projects online and to view their marks.

2.5 Mobile technology learning applications

There are different mobile technology learning applications, which come with different features useful for learning purposes. These applications are called Web 2.0 tools and above, since they are downloaded from the Web or the internet. These applications provide different learning environments which are useful for teaching and learning. The following are some of the Web 2.0 tools which are mostly used with smartphones: SMS, Facebook, WhatsApp, web browsers (Microsoft Edge, Google Chrome), Twitter, Instagram, Google Classroom and many more. Most applications are downloaded from the Google and Apple play stores, depending on the brand of the operating system software that the smartphone device is using. There are many other applications found at the play store which have been designed to help children learn, for example Kids Maths (<https://www.parents.com/kids/education/math-and-science/best-math-apps-for-kids/>) which is an application which helps young children to do Mathematics and to read and write.

2.5.1 Short Message Service

Short Message Service (SMS) is used to send messages to a group of individuals on what to do. It is mostly used in education to send messages to learners to remind them of registration dates, what to do for their homework and what to expect in class, school opening and closing dates, and so on. A study by Smith (2012) has reported that the use of SMS has potential for learning enhancement. This was supported by Cifuentes and Lents (2011) in their study, which concluded that SMS has a potential for learners to be active in communication. SMS is also used to act as a reminder to learners on what they are going to do on particular dates. Previous studies examined different Instant Messaging services. A study by Hrastinski, Edman,

Andersson, Kawnine and Soames (2014) concluded that learners received support in Mathematics from their peers and teachers by using SMS. They were able to ask questions during the learning process and after school hours. This shows that SMS is a very good application that can be used to improve academic performance. SMS also provides confidentiality in the sense that teachers were able to identify learners who needed help and help them individually in and outside classroom contexts (Scornavacca, Huff, & Marshall, 2009).

2.5.2 Facebook

Facebook is a Web 2.0 tool that allows people from different locations to have peer-to-peer conversations online and interactively, where they can share and exchange content, be it text, video or audio. The two parties first have to set up a user profile with their demographic details. Friends or individuals can look up one's profile and send friend requests in order to get into contact. Approved friends are able to interact around the content that is shared between them through public or private messages and a chat feature. Users can let people know what they are doing by updating and uploading statuses. From a teaching perspective members can set up public or 'closed' groups in which they can post announcements and updates on their academic life. Everyone has the chance to login and access materials, provided they do not login after deadlines have elapsed. Teachers and learners create Facebook groups which they use for group collaborations (Fewkes & McCabe, 2012; Wang, Woo, & Quek, 2012) and promotion of social interaction (Wang, Woo, & Quek, 2012) and continuing learning beyond classroom contacts (Fewkes & McCabe, 2012; Wang, Woo, & Quek, 2012). Madge et al. (2009) in their study concluded that Facebook is an important tool in learners' social integration and learning at the university. Learners showed that they use Facebook for academic matters, such as creating project work groups and any other matters which concern their education.

2.5.2.1 Benefits of Facebook in education

Most learners have knowledge of how to use Facebook, and most of them use ‘Zero Facebook’, which requires only a smartphone with no data charges applying in connecting to it. This is the cheapest method and is preferred by most learners, as they do not have to pay for anything, although they do not have access to pictures. Selwyn (2007) concluded that Facebook was being used for the following reasons by learners:

1. Exchange of practical information;
2. Exchange of academic information and sending notifications to others about various pieces of subject matter; and
3. Soliciting help from teachers and other learners.

The Facebook learning environment goes beyond the classroom contacts and can assist one in helping to manage collaborators when used for purposes of education. Facebook supports online learning in the sense that collaborators will be talking to each other from different locations; if used for educational purposes there will not be a time limit as material and course content will be available 24/7. Learners can also share their social statuses so that others can help them, and thus learning continues. Academic groups can be formed on Facebook, which ensures smooth operation and running of the groups by the group administrators. Steinfield and Lampe (2007) found that using the platform could significantly increase a learner’s interaction and expanding informal learning, from the sharing of educational resources and materials, to bonding socially around education activities. Deadlines for essays, timetables and news items from around the internet can be shared and discussed without wasting any time. People and learners express themselves through this platform and communicate in a written format, where the other party will respond at the other end also in a written format. Authors such as Bugeja

(2006) and Ziegler (2007) believed that the application involved learners in their teaching and learning as it helped motivate learners in learning.

2.5.3 WhatsApp

WhatsApp is a mobile messaging alternative to texting that uses data plan or Wi-Fi connection. Users can send and receive messages free with anyone else who uses the app.

Learners and facilitators can send unlimited text messages (Bouhnik & Deshen, 2014) and video content, even internationally. Users can also set specific groups for messaging. Instagram, Twitter and all the other applications work the same as WhatsApp: these are information-sharing applications which can be used to transmit information to and from users. Oliveira (2013) noted that WhatsApp is the main communication platform in teaching and learning.

WhatsApp has been used as a tool that in education to send notification to learners and teachers on what is of paramount importance in their education. Teachers created groups and added their learners in order to connect and communicate daily (Smith, 2015). Learners were assigned responsibility for their own learning and teachers would monitor and evaluate their learning progress as they have become active and independent learners (MacHemer & Crawford, 2007).

2.5.4 Twitter

Twitter has been used as a learning tool in collaboration between teachers and learners. Learners' enhancement has been achieved using Twitter and learning was greatly influenced using this tool (Gao, Luo & Zhang, 2012; Leitch & Warren, 2011).

2.6 Types of learning

2.6.1 Mobile learning

Mobile learning is the type of learning which takes place on the go, when mobile (as the term 'mobile' implies). One learns at one's own speed, using any mobile device of choice. Technology has advanced in that there are so many applications which one has to connect to using mobile technology devices or smartphones to learn online. This type of learning is called electronic learning, or e-learning for short. Distance education is also done using mobile devices; in this type of learning people connect to different applications and are able to learn from different parts of the world online, thus the term 'distance' learning. Mobile learning is called many different things, but they all mean learning while mobile. One common definition of mobile learning is learning with no time limit, which is learning beyond the classroom. In other words, mobile learning is considered to be the type of learning that uses mobile technology devices to support teaching and learning (Crescente & Lee, 2011).

It is widely acknowledged that implementing mobile learning via mobile technologies may lead to greater opportunities in teaching and learning (UNESCO, 2012a). A UNESCO (2012b, p. 6) paper states that "with mobile technologies, by far the most universal interactive information and communications technology on earth which can be used to deliver and improve education, they carry a remarkable potential to assist learning everywhere". DeWitte (2010, p. 45) supports this when he states that learners wish to carry their mobile technology devices to school and to be allowed to use them for learning purposes; however, teachers have a different opinion about learners bringing their devices to school. The above sentiments from UNESCO (2012a, 2012b) and DeWitte (2010, p. 45) agree that mobile technology devices are fruitful for enhancing teaching and learning and thus improving academic performance. These are the sentiments that this study sought to explore. UNESCO (2012a, 2012b) and DeWitte (2010, p.

45) stated though, as hypothesised, that the mind-set of the school administrators and teachers is a barrier to learning using mobile technology devices.

2.6.2 Collaborative learning

In collaborative learning people agree to learn the same concept together; this is working in pairs or groups, helping each other to learn. Roschelle and Teasley (2010), supports this by defining collaboration as a mutual engagement of participants in a coordinated effort to solve a problem together. They further noted that collaboration takes place within a joint problem space which people try to solve. Learners can work collaboratively with others in different locations using smartphones; they agree on the time and the space to use when learning. When the time comes, all the learners will be connected through some virtual learning environment, where they will share content and engage in a live discussion. This gives everyone an opportunity to learn since everyone will be there – not in the same building, but virtually. They will be able to send class content and course material to each other quite simply and to engage. This makes learning easier.

2.6.3 Personalised learning

This is the type of learning in which one is responsible for one's learning. Different search engines and e-learning platforms can be used. Learners can use mobile technology devices for personalised learning. Learners are able to use the features of mobile technology devices to capture class content, which they will then use later to educate themselves. This is learning that combines the delivery of education both within and beyond the classroom environment to make learning an endless process which occurs 24/7.

2.7 Internet access and use among young people

The internet has taken the whole world by storm. Almost all areas have internet access – cities, towns, rural and urban – across the world. Internet rate reductions and drops in data charges

have made it possible for many people to have access to the internet. Young people (18-24 years old) are said to be the most connected age group, followed by slightly older adults (Smith, Raine & Zickuhr, 2011). In Botswana the Government has committed to improving the lives of the people through technology, as was enshrined in the country's Vision 2016, which has now been achieved. The development of technology in African countries has taken the centre stage, with countries working to broaden access to the internet and improving technical performance. This was seen in the years 2013 to 2016, when the Government of Botswana connected major cities and towns with internet access. This increased the number of people in Botswana with internet access.

The tourist industry in Kasane (North West Botswana) has improved access to internet by tourists there by installing and making available free timed Wi-Fi in the area. Many people own and have access to mobile technology devices and computers to connect and surf the web, mainly due to the reductions in prices of ICT tools such as computers and provision of refurbished computers in Botswana *kgotlas* and primary schools in rural and remote areas, which has been completed by the Department of Science and Technology. This was a welcome initiative, because even the remotest villages that had no access to networks and the internet now do. This has borne fruit, as now people are able to work in different parts of Botswana because there is access to internet and a full coverage network. Many schools and offices have been equipped with computers and have internet access. The Government of Botswana is committed to providing technology infrastructure to different departments and communities in the country to increase access to technology by different sectors of the population.

The Botswana Government, through the Ministry of Communication, Science and Technology, has developed an ICT policy that provides a roadmap to drive technology implementation in the country. The internet connection and access has proved to be a very important tool in

enhancing the quality of education and improving basic services in healthcare, education and many more.

Long back there used to be poor internet services and poor network reception in Botswana, but as mentioned, the Department of Science and Technology has improved internet connectivity across Botswana. Despite the advantages of learners using mobile technology devices having internet access and connection, the amount of time spent by some learners online is a cause for concern. Many learners spend most of their time on the internet doing non-educational activities, which can lead to their failure. Learners who have difficulty controlling their time spent online may suffer from internet addiction, resulting in their studies being undesirably affected. Much research has been conducted to examine the time spent by learners in accessing the internet. Panayides & Walker (2012) found out that on average university learners spent 164 minutes per day on the internet, which is almost 2.5 hours. Robinson (2005) found that 47% of African-American college learners spent an average of two hours per day online, while a small percentage of the learners spent 5 to 6 hours. If this time spent online on activities unrelated to education was rather spent learning online, good results can be achieved and learning will be improved.

In research involving learners from nine different faculties in a Turkish university, Toprakci (2007) found that 15.4% accessed the internet for more than three hours per day, while 62.9% accessed it for one to three hours per day. If the time spent on the internet is not devoted to social media, then surely good academic results can be achieved in our nations and parents can be made proud by the successes brought about by the internet and mobile technology devices. This study concludes with a recommendation that learners need to be taught and made aware of the good that internet use can bring to their academic life if used purposefully for academic purposes in learning online.

Computer technology has advanced in the sense that it has enabled the internet to serve as a platform not only to look for information, but also to exchange ideas and knowledge between users, and to obtain expert opinions through the use of email, teleconferencing, chatting, video conferencing and many other means.

2.8 Household access to internet in Botswana

According to the Botswana ICT Survey of 2014, 40.6% of households had access to the internet. The majority of households with access to the internet use services provided by the Botswana Telecommunication Corporation and other internet service providers such as Orange Botswana, BeMobile Botswana and Mascom Botswana. According to Statistics Botswana (2014) the city of Gaborone is the area most connected with internet in the country. Kweneng East District and Ngwaketse followed with 11.4% and 7.1% respectively. This is why purposive sampling was used to collect data for this study in the greater Gaborone district. This shows that, with the massive connection to the internet and ownership and access to mobile technology devices, these can be used to advantage and assimilated into education to bear good results. The majority of mobile cellular telephone users spend most of their time chatting and sending and receiving short messages as well as playing music and videos.

2.9 Cell phone access in Botswana

According to Statistics Botswana (2014), 85.3% of the nation's population used and have access to a mobile cell phone. This shows that the majority of people in Botswana are connected to the internet and have access to a cell phone. The majority of mobile cellular telephone users spend most of their time chatting and sending and receiving short messages through social media; some play music and transfer files between each other and send videos.

2.10 Household access to a computer in Botswana

The 2014 ICT survey showed that 20.6% of Batswana owned a laptop, while 10.9% owned a desktop computer. This helps with access since the fact remains that almost everyone (85.3%) has access to the internet and a mobile technology device. These can be used in learning to achieve good results. Gaborone, Kweneng East, South East and the Francistown regions had the most households with computers. Since the technology has changed and the price of acquiring computers and smart phones has gradually dropped, the majority of people, including learners, have access to smart phones and computers with internet access. Advantage can be taken of this ownership of technological gargets and they can be used to enhance teaching and learning (Statistics Botswana, 2014).

2.11 The use of mobile technologies in teaching and learning

ICT tools have been used in the teaching and learning of learners for a long period of time, but without a focus on smartphones. That is why this study was carried out to investigate if smartphones can be used to enhance teaching and learning. Mobile technologies in general have different applications with very good features, which can be taken advantage of and used in the education of learners. Learners can use these devices to enhance their teaching and learning.

2.12 Smartphone ownership in Botswana

According to research conducted by the World Bank (2012), Botswana is surpassing many African countries in terms of accessibility of mobile phone subscription charges, because prices have gone down and internet charges are very low. According to the World Bank *Information and Communications for Development Report 2012*, Botswana's mobile cellular subscription per 100 people is 144 – one of the highest in the world. This shows that the majority of people

in the major towns and cities of Botswana have access to smartphones or any mobile technology device of their choice.

2.13 Advantages of using smartphones in education

Smartphones are small, light in weight and easier to carry than other mobile devices, which require a carry bag to move around with and are fairly heavy – even though they have the same features and functions. Some of the useful features include the ability to access information, record data, and create podcasts (Chartrand, 2007). Smartphones can be used anywhere and at any time, for example while on the bus, in and between classes, in a queue or on the playground. This means that learning can take place anywhere, even outside classroom contact hours. There is no physical boundary or limit on the use of smartphones, as the content in them can be accessed from anywhere with no time limit; learners can collaborate with others and their teachers thorough embedded Web 2.0 tools which come with their smartphones. Smart phones such as iPhones, Android phones, BlackBerrys and Windows phones, personal digital assistants, tablet computers and many more have been used in class for many years now, mostly for phone calls and SMSs (Rodríguez, 2015). Learners with smartphones have more at their fingertips than those who do not have them and these can be used in teaching and learning.

Smartphones give learners a variety of options to enhance and satisfy the classroom experience (Norris, Hossain, & Soloway 2011). This includes, among others, access to the internet to open search engines and get required content anywhere, and access to email to communicate with each other and send assignments to lecturers. They also give the opportunity and ability to take educational videos and pictures to be used during their own time outside classroom contact hours. This enhances their learning. The following are benefits of the use of smartphones in the classroom:

- Smartphones allow learners to learn comfortably. More and more children have access to smartphones and are very aware of how to use them and the applications embedded in them. This makes learners comfortable when learning using smartphones.
- Smartphones enable learners to get answers quickly. If clarity is needed and the learners are afraid of the teachers or lecturer or discrimination from fellow learners, he/she will open a smartphone and type in questions leading to possible answers. This makes learning using smartphones an easy task and enjoyable.

The audio and video capabilities of smartphones can bring learning to life within the classroom. Learners are able to record the classroom and record the audio. When the learner is alone they can open the video and listen to the teacher on their smartphones. This enables them to capture what was missed during class teaching. Graphic images may also be taken, which learners can use later to evaluate the class. This makes learning using smartphones a benefit rather than a demerit, as concerns teachers. Learners and teachers can video conference and attend a live classroom where they are able to see the emotions and body language of fellow connectors. This makes it easier to understand the concepts as they are revealed during video conferencing. They can also be used as a way to gather data for classroom presentations and enhance interactivity in large classroom settings (Scornavacca, Huff, & Marshall, 2009).

- Smartphones allow social learning, which means learners are able to work in groups, either on assignments or group work. They can agree when to connect to do a live chat on what concerns them.

2.13.1 Distractions

Learners can be distracted while using smartphones during classroom sessions. Someone can send learners notifications which require immediate attention, and this can lead to opening explicit content and engaging in unethical internet behaviour in class. This can and has been reported by several studies as distracting from learning. Learners may spend time texting, surfing websites or chatting online with their friends, which means that they are not paying attention to the teacher (Tindell & Bohlander, 2012) and this can lead to poor academic results. Research carried out by Chaklader and Bohlander (2009) showed that test result performance

is significantly lower for learners who are distracted by mobile devices during a lesson, indicating that there is a loss of concentration if learners are doing non-class-related tasks, Rosen et al. (2011). If smartphones are used for a good reason and purpose, and learners are being counselled on how to use them effectively in class, better results can be attained than when they are not used. Smartphones distract learners because the applications in them are dominated mostly by entertainment and a few on learning (Barnwell, 2012).

2.13.2 Cheating

Learners can use smartphones to cheat during tests and examinations. This leaves them with no knowledge upon completion of their studies because they relied on their smartphones to glean information Rosen et al. (2011). Learners can download and view answers for questions asked in tests and examinations using smartphones, since it may be difficult for teachers and facilitators to observe such cases when they occur if they are busy with the proceedings in the class, tests or examinations.

2.13.3 Technical problems

Using smartphones in the classroom requires that the teachers and facilitators spend a lot of time planning for the lessons, training with the hardware and software before classes begin, and spend some time during class to help learners to troubleshoot issues with the devices. The amount of time spent during class teaching the learners how to use the devices is also a problem, because it consumes much of the time required for teaching and learning.

2.14 Conclusion

The continual decline of secondary school results in Botswana suggests that new teaching methods, like the inclusion of smartphones in teaching and learning, be explored in order to curb this problem. The discussions from the literature review have shown that mobile learning produces good results and makes a positive contribution to teaching. This literature review

shows that learning through mobile devices ensures that learning does not end during classroom contact, but is a continual process which can take place 24 hours a day with no time limit. Review of the literature revealed that there are projects which have been implemented in Africa to enhance teaching and learning, which have been successful in South Africa and Mali. A few studies have shown negatives regarding the use of mobile technologies in teaching and learning.

In this study the researcher investigated the use of mobile technology devices (smartphones) to enhance teaching and learning in Botswanan secondary schools. The literature review led the researcher to the conclusion that the proper use and implementation of and training on the use of smartphones in teaching and learning should be investigated effectively before they are used in the classroom, as this will go a long way towards enhancing teaching and learning in the classroom.

The next chapter discusses the theoretical and conceptual framework of the study.

CHAPTER THREE: THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter discusses the theoretical framework that guided this study. This study was guided by the activity theory, which is a theoretical framework for analysis and understanding of human interaction using tools and artefacts (Hasan, 1998).

3.2 Activity theory

Activity theory employs the whole work activity as a unit of analysis. In this theory the component to be analysed is broken into three parts – the component to be analysed, the tool and the object. For the purpose of this study the tool to be analysed is smartphone use in teaching and learning; this is also the object used by learners in the experimental section to answer the research questions of this study. The subject is the person being studied, who in this study were the learners. This is supported by Hasan (1998). Figure 3.1 shows Engeström's expanded activity theory model, which explains Hasan's sentiments regarding integration of technology as tools mediating social action.

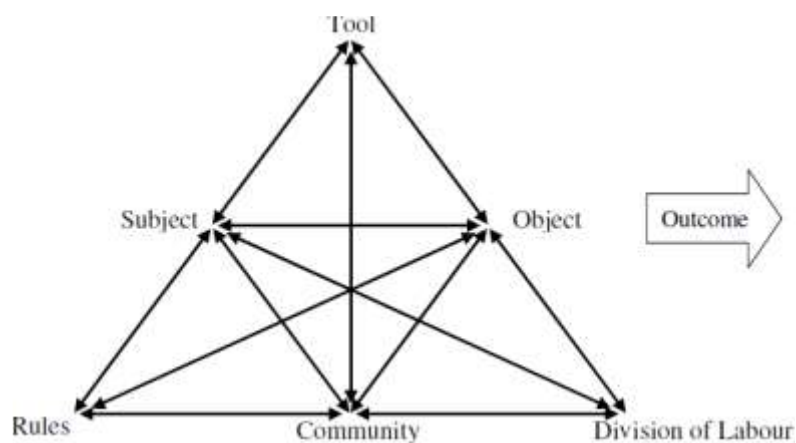


Figure 3.1: Engeström's expanded activity theory model (Engeström, 2001).

Vygotsky (1978; 1987) developed the activity theory model, which includes the three features of the subject, who is the learner; the object, which is the task or activity being conducted or

carried out; and the tool used to effect the activity. An activity is done by a human being, who is the person who is actually conducting an activity. For the purposes of this study the person who was conducting and activity was the learner. Activity differs from other types of interaction in two key aspects: (a) subjects of activities have needs, which should be achieved through an interaction with the world; and (b) activities and their subjects mutually determine one another Kaptelinin and Nardi (2006). Subjects have to interact with the objects in order for them to survive. Kaptelinin and Nardi (2006) noted that although usually concerned with activities of individual human beings, the notion of 'subject' is not limited to individual humans but includes other types of entities, such as teams and organisations. All of these have to interact to make an activity survive in the real world.

Activity theory is based on Vygotsky's key concepts, among others: mediation, internalisation and development of higher mental functions (Núñez 2009). Activities come in different forms, which differ according to: 1) method: how the activity planned is to be carried out; 2) form: what type of activity is to be performed; 3) time: the time taken for the actual activity to be conducted and finished; and 4) space requirements: the space required for the activity to be conducted (e.g. in schools or churches). The difference among the objects of the activities is the main differentiating feature, because they are not of the same form and method. This supports the sentiments of Leont'ev (1978), who agrees that the object in an activity is its true motive, which gives it a determined direction. He further said that it is important to consider that certain activities are more relevant for the subsequent development of the individual than others, and therefore, are considered as the principal ones.

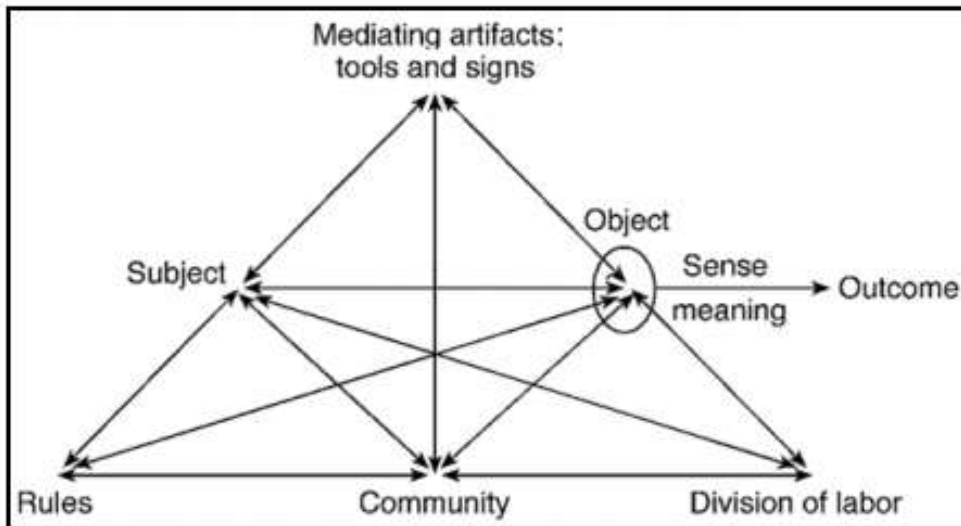


Figure 3.2: The structure of a human activity system – second-generation activity theory model.

Source: Engeström (1987, p. 78; 2001, p. 135).

In Figure 3.2 the oval figure indicates that object-oriented actions are always (implicitly or explicitly) characterized by ambiguity, surprise, interpretation, sense-making, and potential for change (Engeström, 2001). According to Engeström (2001) activity theory’s third generation must develop conceptual tools in order to understand dialogue, multiple perspectives and networks of interactive activities.

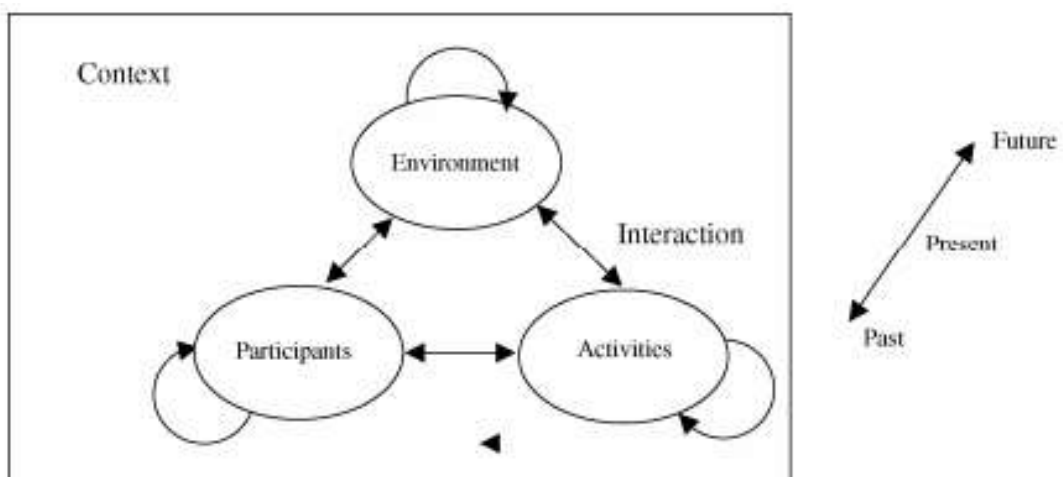


Figure 3.3: Context model (from Tarasewich, 2003).

The context model (Figure 3.3) comprises the environment, participants and the activities. There is interaction between the environment and the activities. The participants include users or human beings who undertake an activity, and activities are what participants do. In this study the teachers and learners were using smartphones in their teaching and learning. An activity was carried out by the participants to effect a change in the environment, which in this case was the education fraternity. Tessmer and Richey (1997) describe the context as being composed of levels as well as factors. According to these authors context is therefore a multi-level body of factors in which learning and performance is embedded; it is not the additive influence of discrete entities, but rather the simultaneous interaction of a number of mutually influential factors. These factors are physical, social and instructional aspects, which interplay to influence learning.

3.3 Conclusion

This chapter discussed the activity theory supporting the investigation in this study. The next chapter discusses the research methodology.

CHAPTER FOUR: METHODOLOGY

4.1 Introduction

This chapter provides discussion on the research context of the study, research methodology, data collection instruments, timeframe for the data collection, data collection methods, how qualitative and quantitative data were analysed, sampling and sampling procedures, validity, reliability, trustworthiness, ethical considerations, limitations of the study and shortcomings and sources of errors for the study.

4.2 Research context

The aim of the study was to determine whether the use of smartphones in the classroom can improve teaching and learning in Botswana secondary schools. The study was conducted in Botswana, a landlocked country in the South African Development Community between South Africa, Zimbabwe and Zambia. It was conducted in two government-aided senior secondary schools in the South East region. The two senior secondary schools were named school A and school B respectively. These schools are in the greater Gaborone region, where there is ample access to internet services and most learners have access to or own a smartphone. For this reason purposive sampling was used, and in total 75 subjects participated in this study, which had a response rate of 100%.

4.3 Research methodology

This study used quantitative and qualitative research methods (a mixed-method approach). Quantitative research is numerical representation and manipulation of observations for the purpose of describing and explaining the phenomena that those observations reflect. According to Cohen and Manion (1980) quantitative research is defined as social research that employs empirical methods and statements, while a qualitative approach seeks to gather an in-depth understanding of human behaviour and the reasons that govern such behaviour – as in this

study, determining if smartphones can enhance teaching and learning and improve academic performance.

The use of mixed methods in this study ensured that there were no ‘gaps’ in the data collected. The benefits of using a mixed-methods approach are that it allows the researcher to collect both qualitative and quantitative data from the subjects (Spicer, 2004).

This study used exploratory and experimental design with two groups of participants, the control group and the experimental/test group. The control group was subjected to and used traditional methods of teaching, and the experimental/test group made use of smartphones in their teaching and learning. The control and experimental groups were in two different schools, school A and school B. No group was aware that there was a control and a test group and what the other group was doing; thus it was a blind study.

The use of questionnaires and focus group interviews enabled the researcher to collect data that were used to provide answers to the research questions under study. The purpose of the interviews was to ascertain the perceptions of learners who were using smartphones as to how they rated and felt about the use of this device in teaching and learning. The experiment section helped to investigate if smartphones can be used to enhance teaching and learning and how best they can be used in the education of learners.

In order to achieve the primary aim of the study, which was to determine whether smartphone use in the classroom can improve teaching and learning in Botswana secondary schools, the following research questions were crafted:

1. What Web 2.0 tools are being used with smartphones for teaching and learning?
2. For what purposes are Web 2.0 tools being used in the classroom with smartphones?
3. Does the use of smartphones affect teaching and learning?

4. How can Web 2.0 tools be used with smartphones to enhance teaching and learning?

Research question 1 was aimed at finding out which Web 2.0 tools are currently being used by learners with smartphones for teaching and learning, and of those being used which is the most suitable. Research question 2 aimed at finding out for what purposes Web 2.0 tools are being used in the classroom, while research question 3 aimed at finding out if the use of smartphones affected teaching and learning. Lastly, research question 4 aimed at finding possible and suitable ways in which smartphones can be used to enhance teaching and learning.

After considering the research methodology and research questions, the researcher decided it would be suitable to use questionnaires, focus group interviews, and control and test (experiment) groups to collect the data to answer the research questions under study. The experiment allowed the researcher to compare the test and examination results from the control and test groups after the test group used smartphones in their teaching and learning while the control group used the traditional method of teaching. This helped to some extent at arriving at the conclusion as to whether to use smartphones in teaching and learning (see the results section).

The focus group interviews helped the researcher to ascertain the perceptions of the test group on how they viewed the use of smartphones in teaching and learning after they had been using them. Table 4.1 indicates the research questions and data collection instruments used in the study.

Table 4.1: Data collection instruments used in the study

Data collection instruments		
Research questions	Questionnaire	Interview
1. What Web 2.0 tools are being used with smartphones for teaching and learning?	√	√
2. For what purposes are Web 2.0 tools being used in the classroom with smartphones?	√	√
3. Does the use of smartphones affect teaching and learning?	√	√
4. How can Web 2.0 tools be used with smartphones to enhance teaching and learning?	√	√

4.4 Study Design

The research design included the use of an intervention and therefore there was a test group and a control group. The control group was taught the same topics but without the requirement of using their mobile phones and no planned activities by the teacher to use their mobile phones. The test group was subjected to the intervention. The intervention was allowing the use of mobile technology devices (smartphones) in the classroom. Only the test group was part of the intervention. The teachers and the learners from the test group used smartphones for teaching and learning during and after classroom contact hours. The teacher and the learners used different Web 2.0 tools as follows.

4.4.1 Facebook

The teacher and the learners signed up on Facebook and then the teacher set up a closed group where he was communicating with the learners, sending them educational content materials to read and view. All the learners in the intervention group asked to join the group and the teacher

accepted their requests. A wall was used for posting comments, questions and purpose of the group. A news feed was used by both parties to send questions about certain questions and answers to the said questions after discussions. The learners were given time to post their responses and the teacher guided all the comments until the learners arrived at a correct answer. Learners posted questions where they needed clarity on the news feed and the teacher responded on the same platform for all the learners to see and comment. The main page allowed both parties to see the latest activity from all the group members. Learners understood how to use Facebook well. Practice questions, assignments, tests and submission dates were posted on Facebook as a reminder to learners by the teacher so that they did not fall behind. Videos and photos were shared with the entire class on particular topics to help learners understand easily. Shy learners who were afraid to approach their teacher after class or during office hours used Facebook to communicate. The teacher posted the test marks to each individual after he or she had written the test through messenger (a private messaging platform offered by Facebook).

4.4.2 WhatsApp

The teacher set up the WhatsApp group and added all the learners in the group. The group was used to send reminders about tests, assignments, discussion topics and other educational content materials. Each learner had a chance to post his or her responses. The learners and the teacher worked successfully as they were always communicating every time something came up. There was easier communication and exchange of educational materials such pictures, audios and videos which others had the chance to analyse and send feedback. Learners watched videos before and during class and they were able to ask and answer questions about the videos in their WhatsApp group. WhatsApp enabled the teacher and the learners to stay in contact with each other after classroom contact hours. Graphs and charts were circulated among learners to analyse and provide feedback in class. The teacher sent the next class topics so that learners could discuss them before class. This helped the learners to be engaged and always

involved in the class. The use of WhatsApp facilitated real-time communication between teachers and parents. Parents were able to communicate with the teachers on their learners' progress. Overall, learners responded positively to teaching and learning using this platform.

4.4.3 YouTube

YouTube was used to view and watch educational videos about certain topics. The teacher recorded himself in videos discussing on certain topics and uploaded them online on YouTube for the learners to be able to watch on their own time, more especially during weekends and public holidays. Videos were played in the computer lab during class times and learners were asked to comment, ask and answer questions relating to the topic. It was also used as a reference in WhatsApp and Facebook where teacher and learners directed others to check for more information. The teacher made sure that privacy controls available in YouTube were activated. This helped to screen out potentially offensive content that the teacher did not want the learners to see.

4.4.4 Email

Email was used by learners to submit assignments to the teacher. This was not a requirement since most learners did not have data bundles to connect to the internet compared to those of Facebook and WhatsApp, which are cheaper. It was used by those who wanted to. The teacher also used email to send questions to his colleagues and receive solutions, which he sent to learners through WhatsApp, Facebook and Twitter.

4.4.5 Web browsers

Web browsers such as Google chrome, Internet Explorer, Opera Mini, Mozilla Firefox and many others were used to connect to the search engines such as Google and Yahoo. The search engines enabled learners to find appropriate materials for the different topics. Learners connected to the internet through these web browsers to look for information, which they

shared with others. The teacher allowed learners time during lessons to connect to the internet and use search engines to verify their facts from other studies before they can present them to the class.

4.5 Timeframe for data collection

The data were collected for a period of one school term, which in the Botswana education school calendar system is four months. First the school heads of both of the selected schools were notified about the study after obtaining permission to conduct the study from the Ministry of Education and Skills Development (see Appendix IX). Permission was sought from the schools and then the researcher met with the teachers and briefed the learners about the purpose of the study and its importance in their education. Consent forms (See Appendixes III, IV, V, VI and VII) were sent to the parents through the selected learners and questionnaires were given to the teachers to distribute to the learners after the return of the consent forms. The experiment started a week after the return of the consent forms from the parents, allowing their children to be part of the study. The data were collected from January to April, and the focus group interviews were conducted in the last week of April when the schools were about to close.

4.6 Administration of Questionnaire

The control group based their responses on their general experiences on the use of smartphones since they were not required to use them, unlike the test group who were required to use them by their teacher. The questionnaire was distributed and collected by the teachers at the two schools, and consisted of closed-ended and open-ended questions. The closed-ended questions were analysed quantitatively while the open-ended questions were analysed qualitatively.

4.6.1 Importance of the questionnaire

The advantage of using a questionnaire in this study was that large amounts of information could be collected from a large number of people in a short period, and in a relatively cost-effective way. The results of the questionnaires can usually be quickly and easily quantified by either a researcher or using software called SPSS. When data have been quantified they can be used to compare and contrast other research, and may be used to measure change. Panayides & Walker (2012) pointed out that a questionnaire is quick and easy to fill in and is directly and immediately accessible to the researcher while ensuring confidentiality; this was the case in this study.

Initially the researcher had selected 80 data subjects, each school having a total of 40 subjects respectively. All 40 questionnaires were returned from school A, while only 35 were returned from school B. This gave a total of 75 returned questionnaires for the study. All of the data from the questionnaires were captured and entered into SPSS for analysis. A total of 43 males and 32 female learners from schools A and B, with ages ranging from 16 to 19 years, took part in the study.

4.6.2 Design of the questionnaire

The structuring of the questionnaire was influenced by the related literature review and consideration of the aim of the study. The questionnaire used in this study was adapted from the study by Wali (2008), and helped collect the data which addressed the research questions under study. This questionnaire was edited so that the questions suited the aim of the study. It contained both closed- and open-ended questions. All responses from the questionnaire were entered into SPSS to make the analysis easier. See Appendix I for the questionnaire.

4.7 Interview

The second method of data collection was the interview. The interview was conducted at school A only, because this was where the mobile technology devices and/or smartphones were being used in their teaching and learning for a period of one school term of four months.

School B was not aware that school A was using smartphones for learning. In the last month when the schools were about to close and after the learners in school A had completed their tests and examinations, focus group interviews were conducted with the learners. Forty subjects participated in the focus group interviews.

The interviewees were divided into groups of four, and each was given a time slot to be interviewed. This is supported by Gilbert (2001, pg. 43), who commented that “a focus group is simply a group interview or a group discussion consisting of about six to ten individuals who meet together to express their views about a particular topic defined by the research”. The particular topic for the purposes of this study was the use of smartphones in teaching and learning. The purpose of the interview was to gather data on the experiences and perceptions of learners on the use of mobile technologies or smartphones in teaching and learning. All of the responses were grouped together, and similar responses were analysed together.

4.7.1 Design of the interview

Interview questions were drawn up (see Appendix II). All of the dates and times on when learners were to be interviewed and the meeting places were sent through via their teachers, who were the go-betweens linking the researcher and the learners. The interview questions were not adopted from any previous study. After the questions were drawn up they were sent to the learners via the teachers, so that they had enough time to process what they were going to be asked during the interview section. Focus group interviews encouraged the respondents

to provide different responses based on their experiences with the use of smartphones, and to express their views and perceptions (Welch et al., 2005).

4.8 Sampling

Purposive sampling was used in this study to select participants in and around the south inspectorial region of Botswana in the South East district of the country. This was done because in most rural areas of Botswana there is poor network reception, which results in no access to the internet and limited use of mobile technologies. Two schools were selected and again purposive sampling was used to select the school (school A) which was home to the test group and school B which was that of the control group. The population was Form 4 and Form 5 learners in Botswanan secondary schools and the sample size was 75.

4.9 Experimental data

Data was collected from the tests results of both the control and test groups. There were two tests, test 1 and test 2, which contributed to the final mark for the term, which was considered the final exam mark. There was no examination because the Form 4 learners started school two weeks later than the Form 5 learners, so a mini scheme of work was designed to cover only the time they spent in term 1. The two schools wrote the same tests. The first test was written after the subjects in school A had used smartphones for 2 weeks; this was to allow them to become acquainted with use of the smartphones. The second test was written at the end when school A had finished using mobile devices in the teaching and learning. With the control group (school B), the teacher did not encourage the use of smartphones or mobile technology devices. They wrote the two tests on the same days as the test groups, but were discouraged from using the smartphones. The two test results from the control group were compared to those from the test group to determine if the use of smartphones had enhanced teaching and learning and increased academic performance.

4.10 Validity and reliability

A pilot test was done in school A to show reliability. After the questionnaire was designed it was piloted and given to learners through their teachers; responses were noted and necessary changes were made. This questionnaire was adapted from that used in the study by Wali (2008) to help collect data that addressed the research questions under study. Using the provisional acceptance and granting of the ethical clearance the researcher went ahead and did the piloting in school A, but only did full data collection after the full ethical clearance was received (see Appendix XI). This enabled teachers and learners to gain an understanding and appreciation of the purpose of the study. Data collection for the study took place during the months of January to April 2017. Trustworthiness was considered, as well as transferability and auditability, to deal with issues of rigour.

According to Burns (2000) reliability is concerned with consistently obtaining the same result under the same conditions, while validity is concerned with an assessment or judgment measuring what is supposed to be measured. In this study the pilot study helped in assessing whether learners owned or had access to a smartphone and whether they were able to use Web 2.0 tools in teaching and learning. The results and conclusions of the pilot study gave this study the green light to go ahead. The interview questions and application which was used for the pilot experimental test (WhatsApp) were handed over to teachers and learners to assess their reliability.

4.11 Ethical considerations

Since this study involved human participants, ethical considerations were of paramount importance. All of the participants who were interested in taking part in the study were accepted, and those who wished to leave the study were free to do so without any delay or pressure. No one was forced to take part in the study without his or her consent. No learners

below the age of 18 years were allowed to participate without their parents' or guardians' consent. All of the data provided during data collection were treated with confidentiality and no names were revealed to anyone. Letters of consent were sent to parents/guardians to sign to allow their children of below 18 years of age to take part in the study. Letters of permission to conduct the study from the Ministry of Education and Skills Development were also obtained before the study could take place. The requirements of the Humanities & Social Sciences Research ethics administration, research office and ethical guidelines were considered and incorporated into the planning of this study.

The ethics requirements for the research process were followed primarily to avoid accusations of conducting an unethical study. The researcher was also concerned about the informants' confidentiality, and made sure to obtain consent from the participants of the study. Letters were written to those concerned informing them about the purpose of this study, its rationale and the population to be involved, and the kind of information being sought. They were informed that the data were being protected and that the anonymity of respondents would be protected. The participants were assured of strict confidentiality and anonymity and that material from their questionnaire responses and interviews would not be used in any way that would compromise their privacy and dignity.

4.12 Limitations of the study

This study was limited for several reasons. Some learners had access to the internet for only a limited time after school; this was because their parents only allowed them a certain amount of time to use their mobile devices. Teachers were reluctant to allow learners to bring mobile technologies to school, so the devices were never taken to school; learners only used them after school hours and during weekends. Even though teachers at the selected schools were

addressed on the importance of this study, they were still reluctant to allow use of mobile devices in the schools.

There was a challenge in terms of funding to buy smartphones and data bundles for the learners so that the study could continue effectively. Some learners were limited in how they used mobile devices and for how long, since the devices belonged to their parents. Hence most learners missed important points when they were offline or had no access to a smartphone. Some learners were excited to use mobile devices, so deviated from the core activity to doing personal activities. Some learners had access to smartphones but had no internet connectivity, so it was difficult for them to use Web 2.0 tools other than Zero Facebook, so they missed most options like downloading. Teachers and school administrators had no hand in supporting the learners.

4.13 Conclusion

This chapter discussed the methodology used for the study, sampling and sample size, questionnaire distribution and design, and lastly the data analysis techniques.

The following chapter outlines the results obtained from the data that were analysed and conclusions derived from these results.

CHAPTER FIVE: RESULTS

5.1 Introduction

This chapter presents an overview of the analysis of the results of the study, both quantitative and qualitative. It shows results of the study obtained through the questionnaires and focus group interviews. The data was analysed using the SPSS. The chapter commences with demographic information, and proceeds to address each of the research questions.

5.2 Demographic details

Seventy-five learners participated and gave responses in the study, of whom 57% were male and 43% were female (Table 5.1). The study had a response rate of 100%.

Table 5.1: Gender representation of participants in the study

	Gender	Frequency	Percent
	Male	43	57
	Female	32	43
Total		75	100

Table 5.2 shows that the majority of learners owned a smartphone brand manufactured by Samsung, followed by Windows; only a small number owned an Apple smartphone. This might be because although the Apple brand is very popular in Botswana, it is very expensive. Most schools use the Microsoft Office package, which is why most of them prefer a Windows mobile device.

Table 5.2: Smartphone brands owned by learners

		Frequency	Percent
	Samsung	50	67
	Windows	14	19
	Apple	11	15
Total	Total	75	100

The results of the study show that 100% of the learners who participated in the study were aged between 15 and 19 years (Table 5.3). This is the normal expected age of entry to the Form 4 streams in Botswanan education.

Table 5.3: Age range of participants (years)

		Frequency	Percent
	15-19	75	100
Total		75	

Most of the learners had access to and had been using smartphones for a period of between one and three years and more (Table 5.4). This means that the learners are very conversant with the software and Web 2.0 tools used with smartphones. They know how to use these devices and are aware of all of the features embedded in them.

Table 5.4: Length of time that learners have been using smartphones

		Frequency	Percent
	Less than a year	16	21
	Between 1-3 years	31	41
	More than 3 years	28	37
Total		75	100

The following questions (5.3, 5.4 and 5.5) were answered only by the test group.

5.3 Research question 1: What Web 2.0 tools are being used with smartphones for teaching and learning?

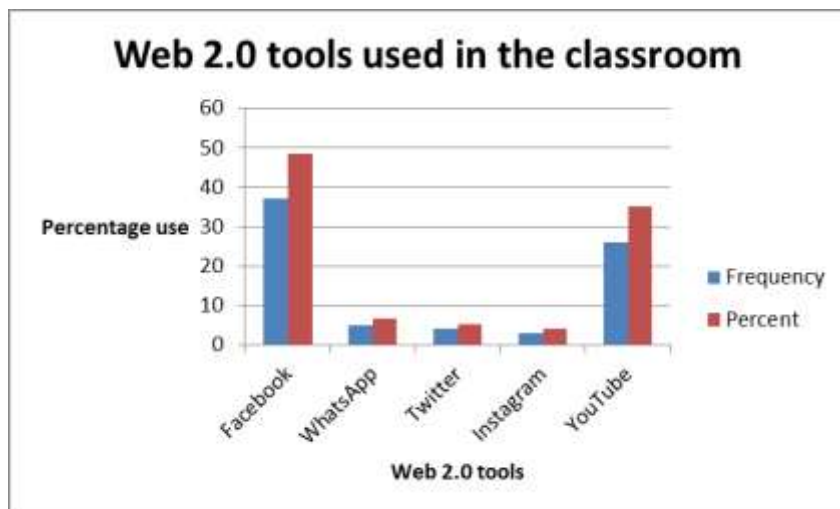


Figure 5.1: Web 2.0 tools used inside the classroom.

It is evident from Figure 5.1 that Facebook is the Web 2.0 tool that is most used in the classroom, followed by YouTube. Many learners have access to Facebook since it is used worldwide to connect people from different parts of the world and communities. There is also Zero Facebook, which is connected to free of charge provided that one has access to a smartphone. Many learners reported using Zero Facebook. The results also show that 7% used WhatsApp, 5% used Twitter and 4% reported using Instagram. YouTube is used mostly by teachers when they show learners educational videos in class, which helps the learners to be able to recall what they have seen and learnt in the previous lesson.

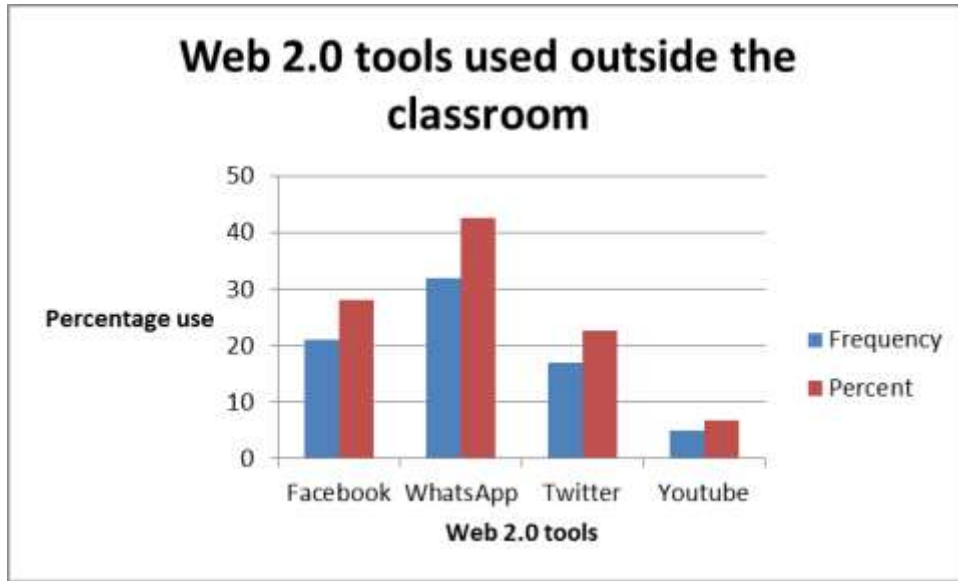


Figure 5.2: Web 2.0 tools used outside the classroom.

Figure 5.2 shows that most learners used WhatsApp outside the classroom, followed by Facebook. In Figure 5.1 and Figure 5.2 it is evident that of all the Web 2.0 tools used for learning purposes in and outside the classroom, Facebook and WhatsApp are those used most, followed by YouTube, Twitter and lastly Instagram.

Table 5.5: Usefulness of WhatsApp and Facebook when used outside the classroom

	FaceBook use outside Classroom		Whatsapp use outside Classroom	
	Frequency	Percent	Frequency	Percent
Not useful	36	45	4	5.4
Somewhat use	30	42	23	31.1
Very useful	6	9	44	58.1
Dont know	3	4	4	5.4
Total	75	100	75	100

WhatsApp is found to be very useful outside the classroom, and more so than Facebook, as show in Table 5.5. This might be because the network service providers have introduced data plans which are cheaper to buy and last for a longer time; for example Mascom, Orange and BeMobile Botswana have cheap plans to buy data, and all of the data and internet rates have gone down. Parents subscribe for their children to be able to use their smartphones for communication with friends, including on matters concerning their education. Learners are

able to send educational materials to each other like uploading videos, text and many more through WhatsApp at lower data charges.

5.4 Research question 2: For what purposes are Web 2.0 tools being used with mobile technology?

Learners used Web 2.0 tools for several things: taking notes, viewing lecturer notes, accessing the internet, chatting with friends and reading email. Table 5.6 shows that YouTube was mostly used for taking notes, viewing notes and accessing the internet by learners. Learners used Facebook more than the other Web 2.0 tools for chatting with colleagues and reading email. Most of the learners used all of the Web 2.0 tools for educational purposes, depending on the application and how it could be used.

Table 5.6: Purposes for which Web 2.0 tools are used with smartphones inside the classroom

	% Taking notes	% Viewing notes	% Accessing Internet	% Chatting with colleagues	% Reading Email
Facebook	33	32	21	54	54
WhatsApp	20	23	5	34	46
Twitter	3	3	25	2	0
Instagram	3	0	2	8	0
YouTube	41	42	47	2	0

Table 5.7 shows activities which the learners used smartphones for. The results show that an average of 81% could do almost all of the activities using Web 2.0 tools with smartphones. All of the learners (100%) could take pictures, record videos, edit pictures and text. This is good because learners use these tools in their school work to enhance their teaching and learning.

Table 5.7: What learners could do using smartphones (%)

	% Email	% Chat with friends	% Add comments on social media	% Manage class schedule	% Take pictures	% Record video	% Upload pictures on the web	% Upload movies on the web	% Edit pictures	% Edit movies	% Edit text	% Create animations
Yes	55	91	99	89	100	100	57	73	100	45	100	64
No	45	9	1	11	0	0	43	27	0	55	0	34

Learners used mobile technology devices for different reasons (Table 5.6 and Table 5.7). It is shown in Table 5.8 that most learners use smartphones to share notes with classmates, followed by emailing teachers and other uses.

Table 5.8: Purposes for which learners use their smartphones for learning (%)

	% Lookup subject time table	% Emailing teachers	% Read class notes	% Do literature search	% Surfing the web for learning	% Share notes with class mates
Yes	40	96	93	27	93	100
No	60	4	7	73	7	0

Table 5.9: Communication with other learners using Web 2.0 tools

Question	Responses	Researcher's conclusion
How has the use of Web 2.0 tools with smartphones helped you to communicate with others?	<ul style="list-style-type: none"> - It is easy for me to communicate with other learners who are far away when we are not at school. - It helps me to ask help from others if I am in need. - It has improved my English since I was able to read and type and it suggested good English words for me. - I can chat with others and get updates for school and ask information about a particular topic if I did not understand in class. - It has helped me to understand topics discussed in class and get snapshots of sample questions; I can also record experiments and play them back at home. 	<p>It shows that Web 2.0 tools are beneficial for teaching and learning. Learners are able to communicate with each other when they need clarity about certain concepts and topics in class. They are also able to converse with their teachers when they have missed some lesson contents.</p> <p>This shows that the use of Web 2.0 tools has been beneficial to the education sector since</p>

	<ul style="list-style-type: none"> - Saves time to send and receive emails since it is fast. - It has helped me to record and watch educational videos after class. - I was able to catch up with information done during class. - Information is shared easier and enquiries can be made and retrieved fast. - It has helped me to communicate easily with the teacher when I needed clarity for something that I missed in class. 	the results have proved that smartphones can be used to enhance teaching and learning.
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Table 5.10: Challenges faced when using smartphones with Web 2.0 tools

Question	Responses	Researcher's conclusion
What challenges did you face when using Web 2.0 tools with your smartphone?	<ul style="list-style-type: none"> - The smartphone sometimes freezes. - Some educational material is not easy to find using Web 2.0 tools. - It was difficult to use it because it was my first time. - Software loads very slowly. - One becomes addicted to the smartphone. - Slow network leads to slow delivery of information. - Low battery power. - Virus attack. - Smartphones needs updates so it is expensive to update. - Most information retrieved from the internet was faulty and not true. - No data bundles to communicate as one has to connect to the internet. - One gets carried away from the school work and loses concentration from the core business. 	<p>From the responses the researcher concludes that just like any other mobile device, there are challenges to be faced, and those challenges need a professional to be able to rectify them for the learners so that learning can continue with no disturbance.</p> <p>It is also concluded that a good and reliable smartphone is needed so that one can avoid these challenges.</p>

5.5 Research question 3: Does the use of smartphones affect teaching and learning?

There were 40 learners in total who participated in the test group. School A had a total of 40 learners who were using smartphones in their teaching and learning, while school B had 35

learners who were not using smartphones in their teaching and learning. The learners at school B were using traditional methods of teaching and were not aware that learners at school A were using smartphones. The results in Table 5.11 and Table 5.12 show the final grades which were accumulated after writing test 1 and test 2. Only the Form 4 learners participated in the experimental section. This was done so that the Form 5 learners' schedule was not disturbed, since they had started their final projects.

Table 5.11: Sample T-tests for test 1

Welch Two Sample t-test	Test 1 (Intervention) against Test 1 (no intervention)	
t = 8.2598	df = 28.235	p-value = 0.00000005125
alternative hypothesis:	true difference in means is not equal to 0	
95 percent confidence interval:	(20.08095,33.31905)	
sample estimates:	mean of x mean of y	(85.75 59.05)

The p-value is less than 0.05, hence the two population means (intervention marks and without intervention marks) are not the same. The test results of the intervention group (test group) were much higher than the control group and were statistically significant at 5% level of significance. This shows that the intervention affected performance of learners in a positive way. The results show that the use of mobile technology devices (smartphones) affects teaching and learning and can be used to improve academic results.

Table 5.12: Sample T-tests for test 2

Welch Two Sample t-test	Test 2 (Intervention) against Test 2 (no intervention)	
t = 9.1604	df = 37.025	p-value = 0.0000000004706
alternative hypothesis:	true difference in means is not equal to 0	
95 percent confidence interval:	(17.56228,27.53772)	
sample estimates:	mean of x mean of y	(84.85 62.30)

The p-value is less than 0.05, hence the two population means (intervention marks and without intervention marks) are not the same. Therefore we can conclude that the results are statistically significant at 5% level of significance. This shows that the intervention affected performance in a positive way.

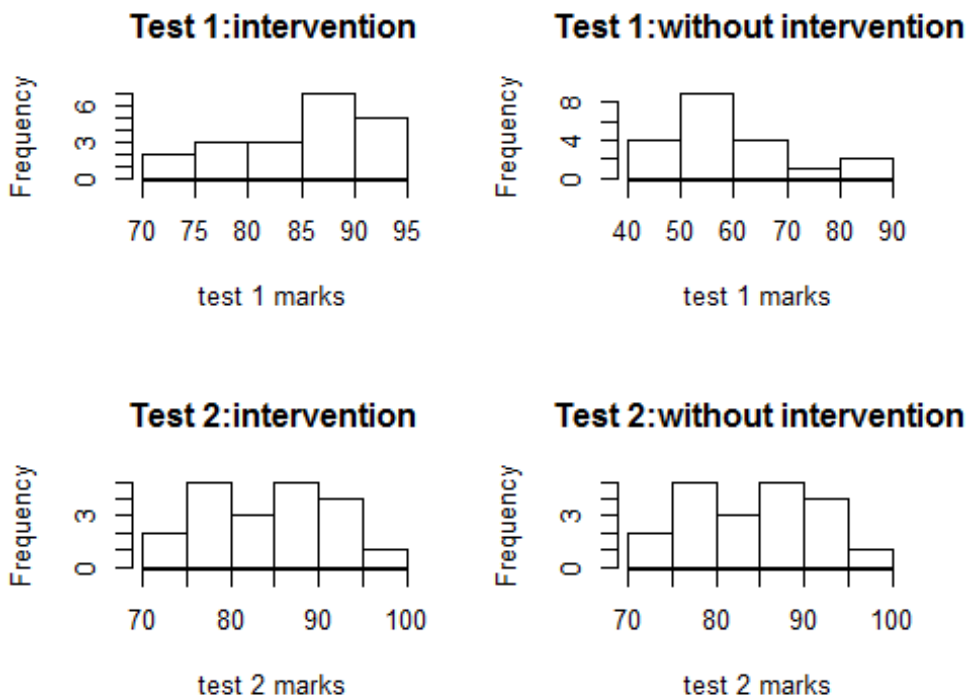


Figure 5.3: Marks for intervention and without intervention

The results show that for the class group with the intervention the minimum mark was 70% and for the class group without intervention it was 40% for test 1. The highest mark for the class group with the intervention was 90% while the maximum mark for the class group without

intervention was 60% for test 1. The results show that in test 2 the marks for intervention were much higher than those of without intervention. One may therefore conclude that all things being equal, that the class group with the intervention did better than the class group without intervention on both tests, therefore the use of mobile technology devices (smartphones) could be considered as enhancing teaching and learning thus increasing academic achievement.

Table 5.13: Effects of not using smartphones in learning

Question	Responses	Researcher's conclusion
<p>I would like to understand the extent to which you use Web 2.0 tools with smartphones in your day-to-day study. In order to help me understand this, I would like you to think about this hypothetical situation: If your smartphone was taken away and you were not allowed to replace it, what effect would this have on you and your school work?</p>	<ul style="list-style-type: none"> - I will not have anything that will help me do my research or contact my friends and teachers for assistance when they are far away. - It may take time to find some information. - I will fail because I download and watch notes from YouTube when I am home after the lessons. - I will not be able to learn more about what I have learnt in school. - I won't be able to research and get into YouTube and Google. - My knowledge will be limited because I won't be able to use Web 2.0 tools to help me with my studies. - I won't be able to get reminders on my school work from my fellow colleagues and teachers; this can lead me to fail. - It will help me focus a lot on my school work, but I won't cope because I have developed a habit of dependence on smartphones. - My level of understanding will go down as I will not have the mobile device to help me. - I won't be able to access the internet and research thus impacting my knowledge. 	<p>The researcher concludes that smartphones with Web 2.0 tools are important in the learning of learners. This is derived from the comments of the respondents, as seen on the left in the middle column.</p> <p>Smartphones help learners to keep on par with their education, and up to date with announcements and reminders from their teachers.</p> <p>A small percentage of learners (about 1%) say that smartphones take all their time, so they disturb them. This is because they have not yet appreciated their use and importance in education.</p>

Question	Responses	Researcher's conclusion
	<ul style="list-style-type: none"> - This can lead to poor communication with family and friends. - I can have more time to concentrate on my studies since I won't have any disturbance. 	

Table 5.14: General comments on using smartphones in learning

Question	General Comments	Researcher's conclusion
What stops you from using your smartphone outside and inside the classroom?	<ul style="list-style-type: none"> - Teachers - Parents - School rules and regulations 	Teachers and parents are the barriers to learners using their smartphones in teaching and learning. This is because of their perceived thoughts on the use of smartphones in education.
How do the tasks set by your teachers encourage or require you to use mobile devices?	<ul style="list-style-type: none"> - learners from the control group responded that mobile devices are not allowed in schools. 	Teachers and curriculum developers must design and develop curricula which infuse the use of technology in teaching and learning.
Has the instructor ever done anything that prevented or discouraged you from using your smartphone?	<ul style="list-style-type: none"> - Our phones are being taken away from us 	Teachers and facilitators are also the barriers to using technology in the classroom. As stated above, curricula must be developed and designed which cater for the use of smartphones in class.

The following research question was answered by learners from the test group only. Table 5.15 onwards summarise the results.

5.6 Research question 4: How can Web 2.0 tools be used with smartphones to enhance teaching and learning?

Table 5.15: Ways of using smartphones in teaching and learning

Question	Responses	Researcher's conclusion
<p>How do you think smartphones can be used in teaching and learning?</p>	<ul style="list-style-type: none"> - learners and teachers can use smartphone by exchanging information about learning, for example, teachers can send us reminders about tests writing, assignment submissions. - We have to be taught how the smartphones can be used in class for the benefit education us. 	<p>Teachers and curricular developers have to include the use of smartphones in teaching and learning as this can improve academic performance.</p>
<p>Has the instructor's use of smartphones in class ever given you ideas for things to do or try? (Please explain)</p>	<ul style="list-style-type: none"> - No because we are never allowed to use smartphones in the school. - The teachers never use smartphones when teaching us. - When teachers use their smartphones they never share with us. - They sometimes laugh and never share with us. 	<p>Teachers and facilitators have had a phobia for so many years against the use of mobile technologies in class, due to their perceived thoughts and reject change.</p>

CHAPTER SIX: DISCUSSION, CONCLUSION AND IMPLICATIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter discusses the finding of this study and the conclusions arrived at from the analysis of results. There were four research questions in this study, and each research question is discussed separately. There were 40 respondents from school A and 35 respondents from school B which made a total of 75 all of whom provided responses. The research questions were examined separately.

6.2 What Web 2.0 tools are being used with smartphones for teaching and learning?

This research found that out of all the Web 2.0 tools available online, on Apple and Google play store, the most commonly used applications for teaching and learning are Facebook, WhatsApp, Twitter, Instagram and YouTube. Facebook is the most commonly used Web 2.0 tool of all, and most learners reported that they had used it and still use it in the classroom. On Facebook, groups are created where learners will be able to collaborate and exchange educational content material, and to post comments and reminders about the assignments, tests and other important class materials so that others can see them. Even though Facebook is of good use in learning, learners use it in class without the knowledge of their teachers, since they fear that their smartphones will be taken by their teachers if caught using them in school.

Despite this, Facebook is an important tool that the learners use and most teachers have started appreciating its use and have made Facebook friends with their learners online. This makes it easier for learners to feel free to ask their teachers some questions where clarity is needed or when they have missed a class. Teachers now post reminders about tests and examinations so that learners are kept up to date with the school's schedule and activities that revolve around them.

After Facebook, the most used Web 2.0 application in class was WhatsApp, which is also a social collaboration application. Most learners reported using WhatsApp more than any other application when they are outside of class. Unlike Facebook, where anything is discussed, WhatsApp has been taken seriously by many people around the world. People and learners exchanged content in the form of videos, text and pictures; in this way learning continues and people are made aware of what is happening around them. Facebook is the least used outside of the classroom because of the content shared on people's walls, which can sometimes be frivolous or explicit.

YouTube is also used in class since teachers connect to it via the internet to download and play educational videos, which helps learners in their learning. Teachers believe that YouTube is the most effective application to use in class for learning, since it does not disturb the class schedule and does not lead to excessive use of time like social media does. Learners also use YouTube to watch educational videos outside of classroom contacts, and thus learning is continuous beyond the classroom walls. Videos are posted every minute on Facebook, but learners need to have to have a good understanding of what they are looking for so that they do not watch content which is wrong and misleading. Learners had a shortcut to the YouTube application on their smartphones, and were able to download the content and take it home to watch offline after school hours.

Instagram and Twitter were also used, although not all of the learners were flexible with its use. Those who used these two applications were familiar with how they worked and the purposes for which they were used, and what direction could be used to cater for the needs of teaching and learning. They do not differ much from other social media or Web 2.0 applications since they also transmit and enable sharing of content in a different format. Most Web 2.0 tools (Facebook, WhatsApp, Twitter, Instagram and YouTube) are used more outside the classroom

than inside, because the learners are afraid to use their smartphones in class because the teachers and school administrators might take them away and deprive them of learning.

If the mobile technology devices (smartphones) were allowed in class and schools the results could improve, as seen in section 6.3 below. Web 2.0 tools are used effectively when one has an internet connection or has subscribed through a network or service provider. Since data charges have been drastically reduced by the service providers in Botswana, it is cheaper for parents to buy data bundles for their children so that they can be able to connect to these Web 2.0 tools and to collaborate with their peers and teachers on education matters. All of this may lead to improvement in education quality and standards.

6.3 For what purposes are Web 2.0 tools being used in the classroom with smartphones?

This research found that Web 2.0 tools are being used for several purposes in and outside of class. The following purposes are those that this study found:

1. Taking and viewing notes: Learners are able to use the Web 2.0 tools to take notes in and outside the classroom environment and view them later when they are reading or doing assignments. This helps them in learning because if they have the notes in their smartphones, whenever they want to read them (even offline) they can access the content at any time. There is also Zero Facebook which shows only texts; learners use this tool to send and share notes with others. WhatsApp is used to send attachments between learners or individuals. The individual to whom the attachment was sent is able to view and download the notes at any time, provided they have access to the internet or have data bundles which allow connection to the internet. The same applies to Twitter and Instagram. YouTube is also used to take notes, since learners open the videos on YouTube and are

able to write notes and summaries from what they are looking at and hearing from the playback.

2. Accessing the internet: This study found out that learners use Web 2.0 tools to access the internet. For example, for one to be able to use a Web 2.0 tool, they need a connection to the internet to be able to view content online if it was not saved to be viewed offline. The internet can be accessed through Facebook, Twitter, WhatsApp, YouTube and Instagram when there are links provided, so that learners can further their knowledge. When they open the link, they have access to the internet. Learners are then able to use the internet and do research online using their smartphones.
3. Sharing and managing information: This study finds that learners are able to share and manage information in many ways with their smartphones using Web 2.0 tools. The following list indicates some of the things learners are able to do in this respect: (a) Read email, and email teachers and other learners. This enables them to be able to exchange educational content, so that they can learn wherever they are. (b) Manage class schedules and subject timetables using their smartphones. This helps the learners because they are able to check and open documents on the go, keeping them up to date about their class schedules and more. (c) Take pictures and record audio. Learners reported being able to take pictures and audio of their class experiments and pictures shown in class. When the learner is alone or away from class, he or she is able to open the videos and pictures and learn more about what was going on in class, some of which may have previously been missed. (d) Upload pictures, movies and video onto the web. Pictures, audio and video can be uploaded onto the web for other learners to be able to view or hear. This study found out that learners are able to do even more than the functions provided by smartphones: they are able to edit pictures, text, audio and video. They are also capable of creating animations using Web 2.0 tools available on Google play store. This shows that learners have a handful

of Web 2.0 tools and that they can do more than what is anticipated they could do as seen above from the findings of the research.

6.4 Does the use of smartphones affect teaching and learning?

This study finds that the use of smartphones affects teaching and learning in a positive way. It found that when smartphones are used, academic performance improves. The average percentage results from school A, which was using smartphones in teaching and learning, on test 1 was a full 27.1% higher than those of school B which was not using smartphones in teaching and learning. The average results for test 2 showed the same trend, that indeed smartphones make a significant difference in teaching and learning: here the result in school A (which used smartphones) was 23% higher than the result for school B. The average test mark for school A was 85.5%, while that for school B was 60.5%. This clearly shows without doubt that mobile technology devices (smartphones) have an effect on academic achievement – and thus an improvement in teaching and learning.

Learners felt that even though they were not allowed to use their phones in class they used them mostly out of class and if this was not possible they may fail. If teachers did not block and bar the use of smartphones in schools, education would be more fun and better academic results would be achieved.

The findings of this study revealed that mobile phone usage significantly influenced academic performance in senior secondary learners. This finding is in line with the early findings of Wang, Wu and Wang (2009), who examined the relationship between use of Facebook and academic performance of learners.

6.5 How can Web 2.0 tools be used with smartphones to enhance teaching and learning?

Conferences and workshops can be given for school administrators and other concerned stakeholders on how to use mobile technology devices in education, and how the curriculum can be crafted in a format which will allow the inclusion of these devices. A pilot test can be done across the whole country regarding adoption of smartphones in teaching and learning. The pilot results would be used to determine the feasibility of the use of mobile technology devices in teaching and learning. The smartphones were used in class and during outside classroom contacts.

Learners used these devices when they were collaborating with others and the teacher. They asked questions and everyone had the chance to comment and the teacher as the subject master corrected them after evaluating all the answers. Reminders were sent to learners by the teacher, reminding them of the test dates and deadlines for submissions of the assignments. The learners were interactive in the discussion forums. Discussions were held every day. The teacher posed questions which learners had to engage and actively interact with and comment on in order to solve the questions. Both learners and the teacher sent education videos and content so that all could have access and learn. Those who did not participate actively were encouraged and data bundles were bought for them so that they did not miss important issues. This is what needs to be done with all learners and ways must be found of encouraging collaboration using mobile technology and Web 2.0 tools. Teachers must be encouraged to integrate these activities into their lessons so that learners may derive the benefit.

6.6 Conclusions

The results from the interventions both for test 1 and test 2 were higher than those without intervention. This implies that the use of mobile technology devices (smartphones) enhances teaching and learning and improves academic results and performance. Different statistical

analyses were used to test whether there is any significant difference among the learners' results in the intervention and without intervention. Findings indicated that there is a 5% statistically significant difference between results with intervention and results without intervention. The significant difference could be considered by the teachers and curriculum developers for future integration of teaching and learning using smartphones.

Although no significant difference has been noticed in the other factors, the average test scores for tests 1 and 2 with and without intervention for both the test and control group were very promising for such factors. It can be concluded that the use of smartphones in teaching and learning can be adopted by both genders without any additional special preferences.

6.7 Implications of the study

The findings of this study have implications for learners, teachers, curriculum developers and policy makers. Web 2.0 tools and above are viewed as learning tools and sources of information. Learners can share learning materials and interact with these tools easily. Technology is improving day by day, so teachers and concerned stakeholders should design appropriate policies for the inclusion of technology in teaching and learning. Learners must be allowed to bring mobile technology devices inside schools and classrooms so that teaching and learning can be improved.

6.8 Recommendations

The researcher makes the following recommendations to learners, teachers and curriculum developers based on the findings of this study:

1. School administrators, facilitators, curriculum development officers, Ministry of Education and Skills Development officials and other concerned stakeholders, teachers and learners

should be oriented and sensitized on the benefits of the use of mobile technology devices to enhance teaching and learning.

2. Ministry of Education and Skills development should consider allocating more funds towards the connectivity of wireless internet access in all tertiary education schools so that learners can use their mobile technology devices in teaching and learning. Internet access is essential for successful connection and use of Web 2.0 tools and above.
3. Workshops, conferences, seminars and pilot tests can be done in order to weigh up the benefits and demerits of these tools and devices for school learners, irrespective of their age, gender and capabilities.
4. Policy makers at local and regional level need to reflect upon school regulations as well as explore reducing data, device and connectivity costs for scholars
5. Support programmes can be offered to parents so that they are made aware of this new, welcome development in respect of the results of this study.
6. All stakeholders involved in the education of learners should be sensitized and advice given by psychologists on the frequency or number of hours or time to be spent by learners on the use of mobile technology devices in teaching and learning.
7. Learners who are addicted to the use of mobile technology devices must know that they should only use these tools for educational purposes while in school.

6.9 Summary

To conclude, smartphones are owned by the great majority of learners and they offer helpful capabilities to both learners and teachers. There are many useful mobile technology tools and Web 2.0 tools at the fingertips of learners that may be used to enhance the teaching and learning process. At the same time, these very tools could represent enormous distractions and have a negative impact on learners. However, if used appropriately and in the way that they should be used, these tools can benefit and enhance the education of learners in a very positive way.

Smartphones are a useful technology in themselves – but how they are used in the classrooms setting should be carefully thought about and designed in order to have a positive influence and to enhance educational achievement.

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APPENDICES

Appendix I: Questionnaire for Form 4 and 5 learners

This questionnaire aims to get your views and experiences in using mobile technologies (smartphones) to enhance teaching and learning. Your participation and contribution are very important and yet voluntary. You are assured that the responses you give and your information will be kept strictly confidential and will be known only to the researcher. Thank you for participating in this study.

Instructions:

1. Please tick the appropriate answer

Demographic details

Gender: Male

Female

Age group

12 - 15	16 - 19	20 - 23	24 - 27
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Standard/Form

4

5

Research area 1 questions: What Web 2.0 tools are being used with mobile technology?

Q1. Which smartphone brand do you use?

Samsung

Windows

Apple

Other (specify)

Q2. How long have you been using your smartphone? (Tick)

Less than a year	Between 1 – 3 years	More than 3 years

Q3. What are the Web 2.0 tools that you use in the classroom? (Tick all that apply)

Facebook

WhatsApp

Twitter

Instagram

YouTube

Other (specify)

Q4. What are the Web 2.0 tools that you use outside the classroom? (Tick all that apply)

Facebook

WhatsApp

Twitter

Instagram

YouTube

Other (specify)

Research area 2 questions: For what purpose are Web 2.0 tools being used with mobile technology?

Q5. What are the purposes of using Web 2.0 tools outside the classroom? (Tick all that apply)

Purposes	Facebook	WhatsApp	Twitter	Instagram	YouTube	Other
Taking notes						
Viewing lecturer notes						
Access internet sites						
Chatting with colleagues						
Reading course material						
Playing games						
Reading email						
Reading e-Books						
Other (specify)						

Q6. What are the purposes of using Web 2.0 tools in the classroom? (Tick all that apply)

Purposes	Facebook	WhatsApp	Twitter	Instagram	YouTube	Other
Taking notes						
Viewing lecturer notes						
Access internet sites						
Chatting with colleagues						
Reading course material						
Playing games						

Reading email						
Reading e-Books						
Other (specify)						

Q7. Please indicate how useful you feel each of the following Web 2.0 tools are when used outside the classroom? (Tick)

	Not useful	Somewhat useful	Very useful	Don't Know
Facebook				
WhatsApp				
Twitter				
Instagram				
Other(specify) _____				

Q8. Please indicate how useful you feel each of the following Web 2.0 tools are when used inside the classroom?

	Not useful	Somewhat useful	Very useful	Don't Know
Facebook				
WhatsApp				
Twitter				
Instagram				
Other(specify) _____				

Q9. How often do you communicate with others (learners/ lecturers) using Web 2.0 tools? (Tick)

	Inside the classroom	Outside the classroom
Daily		
Weekly		
Monthly		
Never		

Q10. How often do you communicate with others (learners/lecturers) using your smartphone? (Tick)

	Inside the classroom	Outside the classroom
Daily		
Weekly		
Monthly		
Never		

Q11. What is the purpose of communicating with other learners and teachers using Web 2.0 tools? (Tick)

	Inside the classroom	Outside the classroom
Discussing topics illustrated in the classroom		
Asking questions about the topics discussed in the class		
Discussing things not related to the discussed topic		

Chatting with friends and family		
Other		

Q12. How has the use of Web 2.0 tools with smartphones helped you to communicate with others?

Q13. What challenges did you face when using Web 2.0 tools with your smartphone?

Q14. General Uses of Smartphones (tick appropriate box)

Can you

- | | | |
|--|--------------------------|--------------------------|
| a. E- Mail? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Chat with friends? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Add comments on social media, e.g. Facebook? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Manage your schedule? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Take pictures? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Record movies? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Upload pictures on the web, e.g. Facebook? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| h. Upload movies on the web, e.g. YouTube? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| i. Edit pictures? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| j. Edit movies? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Create and edit texts? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| l. Create animations? Yes No | <input type="checkbox"/> | <input type="checkbox"/> |
| m. Other (specify) _____ Yes No | <input type="checkbox"/> | <input type="checkbox"/> |

Research area 3 questions: Does the use of mobile technology affect learning?

Q15. How often do you use your smartphone to connect to the internet? (Tick)

daily	weekly	monthly	Hardly ever

Q16. I would like to understand the extent to which you use Web 2.0 tools with smartphones in your day-to-day study. In order to help me understand this, I would like you to think about this hypothetical situation: If your smartphone was taken away and you were not allowed to replace it, what effect would this have on you and your school work?

Q17. Would you like to use your smartphone more outside the classroom?

Yes

No

Q18. Would you like to use your smartphone more inside the classroom?

Yes

No

If “Yes” answer the following question

Q19. What stops you from using your smartphone outside the classroom?

Q20. What stops you from using your smartphone inside the classroom?

Q21. How do the tasks set by your teachers encourage or require you to use mobile devices?

Q22. Has the instructor ever done anything that prevented or discouraged you from using your smartphone?

Research area 4 questions: How can Web 2.0 tools be used with mobile technology to enhance teaching and learning?

Q23. Would you like to use Web 2.0 tools with smartphones more in the classroom?

Yes

No

Q24. If the answer is “Yes” in Q21 above, how do you think smartphones can be used in teaching and learning?

Q25. Do you believe smartphones will/will not be useful for in-class learning activities?

Yes

No

Q26. How often do you use the following Web 2.0 tools with smartphones in class?

	Daily	Weekly	Monthly	Never
Facebook				
WhatsApp				
Instagram				
Twitter				
Other				

Q27. Has the instructor's use of smartphones in class ever given you ideas for things to do or try?

(Please explain)

Q28. Uses of smart phones for learning: When using your smartphone can you:

- a. Look up your subject timetable? Yes No
- b. Email school teachers/classmates? Yes No
- c. Read class notes? Yes No
- d. Do library/literature searches Yes No
- e. Surf the web for learning material? Yes No
- f. Share notes with classmates? Yes No
- g. Other (specify) _____ Yes No

Q29. Where and how often do you normally use your smartphone for learning activities? (tick appropriately)

Place	Regularly	Seldom	Never
At the library			
In the lecture theatre			
During tutorials/ remedial teaching			
Elsewhere on school			
On the go, e.g. on the bus			
At home			

Appendix II: Focus group interview questions for the experimental/test group

- Q1. Which class activities did you carry out when you were using your smartphone together with Web 2.0 tools?
- Q2. How satisfied were you with using smartphones in teaching and learning?
- Q3. When you think of using smartphones in teaching and learning, do positive aspects outweigh the negative?
- Q4. How often do you talk to your friends on your smartphones?
- Q5. How often did you use your smartphone and social media to communicate or socialise with people in your life?
- Q6. How often did you use your smartphone to do research?
- Q7. How has the use of your smartphone in learning affected your learning over time?
- Q8. How did your teacher provide feedback during your learning using smartphones?
- Q9. What challenges did you have when using Web 2.0 tools with your device?
- Q10. Which Web 2.0 tools do you recommend to be used in teaching and learning, and why?
- Q11. Did your parents/guardian support you in the use of your smartphone for learning?
- Q12. How have your teachers used Web 2.0 tools with smartphones in sending you teaching materials and course content?
- Q13. How effective were your teachers with using smartphones to communicate with you?
- Q14. What advice would you give to the education fraternity regarding the use of smartphones in teaching and learning?

**Appendix III: Consent letter and declaration for learners to participate in the focus
group interview**



August 11, 2016

Dear Participant,

INFORMED CONSENT LETTER

My name is Mr. Kgalemelo Rodnie Mafa, a registered Master's learner at the College of Humanities: Faculty of Education (Computer Science Education) at the University of KwaZulu-Natal, Edgewood Campus, South Africa. I am carrying out a research study on the topic:

The Use of Mobile Technology (Smartphones) in Teaching and Learning in Botswana Secondary Schools to Enhance Teaching and Learning

The purpose of this study is to investigate if there is a correlation between the use of mobile technologies and enhanced learning, and to determine how mobile technology can be used to enhance academic achievement or learning.

The findings from the research will be useful for:

- Teachers and administrators in schools to use mobile technology in teaching and learning to enhance academic achievement or learning.
- The curriculum developers to effectively include mobile technology in school syllabuses, as this can help increase results performance.
- The Ministry of Education and Training, which legislates guidelines and policies for teaching and learning in the schools; who will be made aware of other teaching methods which will help in bringing about a significant improvement in academic enhancement.
- The teacher training institutions, which will be made aware of areas in which they need to improve their pedagogy related to technology, to ensure that teachers integrate e-learning effectively in education.

To achieve all this, I would like you to be part of the informants who will be responding to the interview questions with no intervention from anyone. Kindly note that attempts will be made as much as possible not to disrupt the day-to-day running of your lessons and the school.

Please note that:

- Your privacy, anonymity, confidentiality and acknowledgement shall be upheld, your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.
- The questionnaire can be completed in just 20 - 30 minutes.
- Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. Please note that you will not be penalized for taking such a decision.
- Your involvement is purely for academic purposes, and there are no financial benefits involved.
- If you are willing to participate in this study by completing the questionnaire, please complete the declaration at the end of this page. :

In the event of any problems or concerns/questions you may contact the researcher at the following contacts;

Researcher:

Mr Kgalemelo Rodnie Mafa

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: Faculty of Education

Private Bag X03, Ashwood, 3605

Durban, South Africa

Learner ID no: 216076794

Cell: +267 77573849

Email: mafavuke2004@gmail.com

Supervisor:

Prof D.W. Govender

Discipline of Computer Science Education

School of Education (Edgewood Campus)

University of KwaZulu-Natal

Durban, South Africa

Tel.: 031 2603428/3455

Email: Govenderd50@ukzn.ac.za

DECLARATION

I..... (*Full name of participant*)
hereby confirm that I understand the contents of this document and the nature of the research study, and I consent to participate in this research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

.....
SIGNATURE OF PARTICIPANT DATE

Appendix IV: Consent letter and declaration for learners to participate in the research



August 11, 2016

Dear Participant,

INFORMED CONSENT LETTER

My name is Mr. Kgalemelo Rodnie Mafa, a registered Master's learner at the College of Humanities: Faculty of Education (Computer Science Education) at the University of KwaZulu-Natal, Edgewood Campus, South Africa. I am carrying out a research study on the topic:

The Use of Mobile Technology (Smartphones) in Teaching and Learning in Botswana Secondary Schools to Enhance Teaching and Learning

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The findings from the research will be useful for:

Teachers and administrators in schools to use mobile technology in teaching and learning to enhance academic achievement or learning.

The curriculum developers to effectively include mobile technology in school syllabuses as this can help increase results performance.

The Ministry of Education and Training, which legislates guidelines and policies for teaching and learning in schools, who will be made aware of other teaching methods which will help in bringing about a significant improvement in academic enhancement.

The teacher training institutions, which will be made aware of areas in which they need to improve their pedagogy related to technology, to ensure that teachers integrate e-learning effectively in education.

To achieve all of this I would like you to be part of the informants who will be responding by filling in a questionnaire with no intervention from anyone. Kindly note that attempts will be made as much as possible not to disrupt the day-to-day running of your lessons and the school.

Please note that:

Your privacy, anonymity, confidentiality and acknowledgement shall be upheld, your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.

The questionnaire can be completed in just 20 - 30 minutes.

Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.

Data will be stored in secure storage and destroyed after 5 years.

You have a choice to participate, not participate or stop participating in the research. Please note that you will not be penalized for taking such a decision.

Your involvement is purely for academic purposes, and there are no financial benefits involved.

If you are willing to participate in this study by completing the questionnaire, please complete the declaration at the end of this letter.

In the event of any problems or concerns/questions you may contact the researcher at the following contacts;

Researcher:

Mr Kgalemelo Rodnie Mafa

University of KwaZulu-Natal: Edgewood Campus

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Learner ID no: 216076794

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Supervisor:

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Durban, South Africa

Tel.: 031 2603428/3455

Email: Govenderd50@ukzn.ac.za

Or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Thank you for being part of this research.

DECLARATION

I..... (*Full name of participant*)

hereby confirm that I understand the contents of this document and the nature of the research study, and I consent to participating in this research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

.....

.....

SIGNATURE OF PARTICIPANT DATE

Appendix V: Declaration of consent – permission by learners to be audio-recorded



January 12, 2017

Dear Participant,

INFORMED CONSENT LETTER

My name is Mr Kgalemelo Rodnie Mafa, a registered Master's learner at the College of Humanities: Faculty of Education (Computer Science Education) at the University of KwaZulu-Natal, Edgewood Campus, South Africa. I am carrying out a research study on the topic:

The Use of Mobile Technology (Smartphones) in Teaching and Learning in Botswana Secondary Schools to Enhance Teaching and Learning

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The findings from the research will be useful for:

Teachers and administrators in schools to use mobile technology in teaching and learning to enhance academic achievement or learning.

The curriculum developers to effectively include mobile technology in school syllabuses as this can help increase results performance.

The Ministry of Education and Training, which legislates guidelines and policies for teaching and learning in schools, who will be made aware of other teaching methods which will help in bringing about a significant improvement in academic enhancement.

The teacher training institutions, which will be made aware of areas in which they need to improve their pedagogy related to technology, to ensure that teachers integrate e-learning effectively in education.

To achieve all of this I would like you to be part of the informants who will be responding by filling in a questionnaire with no intervention from anyone. Kindly note that attempts will be made as much as possible not to disrupt the day-to-day running of your lessons and the school.

Please note that:

Your privacy, anonymity, confidentiality and acknowledgement shall be upheld, your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.

The questionnaire can be completed in just 20 - 30 minutes.

Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.

Data will be stored in secure storage and destroyed after 5 years.

You have a choice to participate, not participate or stop participating in the research. Please note that you will not be penalized for taking such a decision.

Your involvement is purely for academic purposes, and there are no financial benefits involved.

If you are willing to participate in this study by completing the questionnaire, please complete the declaration at the end of this letter.

In the event of any problems or concerns/questions you may contact the researcher at the following contacts;

Researcher:

Mr. Kgalemelo Rodnie Mafa

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: Faculty of Education

Private Bag X03, Ashwood, 3605

Durban, South Africa

Learner ID no: 216076794

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Supervisor:

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Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Thank you for being part of this research.

DECLARATION

I..... (*Full name of participant*)
hereby confirm that I understand the contents of this document and the nature of the research study, and I consent to participating in this research project and to be audio-recorded. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

.....
SIGNATURE OF PARTICIPANT DATE

**Appendix VI: Consent letter for parents to allow their children to participate in the
research**

Dear Guardian/Parent

My name is Mr Kgalemelo Rodnie Mafa, a registered Master's learner at the College of Humanities: Faculty of Education (Computer Science Education) at the University of KwaZulu-Natal, Edgewood Campus, South Africa. I am carrying out a research study on the topic:

The Use of Mobile Technology (Smartphones) in Teaching and Learning in Botswana Secondary Schools to Enhance Teaching and Learning

The purpose of this study is to investigate if there is a correlation between the use of mobile technologies and enhanced learning, and to determine how mobile technology can be used to enhance academic achievement or learning.

The findings from the research will be useful for:

Teachers and administrators in schools to use mobile technology in teaching and learning to enhance academic achievement or learning.

The curriculum developers to effectively include mobile technology in school syllabuses as this can help increase results performance.

The Ministry of Education and Training, which legislates guidelines and policies for teaching and learning in schools, who will be made aware of other teaching methods which will help in bringing about a significant improvement in academic enhancement.

The teacher training institutions, which will be made aware of areas in which they need to improve their pedagogy related to technology, to ensure that teachers integrate e-learning effectively in education.

To achieve all of this I kindly request you to allow your child to participate in this study, by filling and signing this consent form with no intervention from anyone. Kindly note that

attempts will be made as much as possible not to disrupt the day-to-day running of your child's lessons at the school.

Please note that:

Your child's privacy, anonymity, confidentiality and acknowledgement shall be upheld, and confidentiality is guaranteed as your child's inputs will not be attributed to them in person, but reported only as a population member opinion.

The questionnaire can be completed in just 20 - 30 minutes.

Any information given by your child cannot be used against them, and the collected data will be used for purposes of this research only.

Data will be stored in secure storage and destroyed after 5 years.

You and your child have a choice to participate, not participate or stop participating in the research. Please note that no one will be penalized for taking such a decision.

Your child's involvement is purely for academic purposes, and there are no financial benefits involved.

If you are willing to allow your child to participate in this study by completing the questionnaire, please complete the declaration at the end of this letter:

In the event of any problems or concerns/questions you may contact the researcher at the following contacts;

Researcher:

Mr Kgalemelo Rodnie Mafa

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: Faculty of Education

Private Bag X03, Ashwood, 3605

Durban, South Africa

Learner ID no: 216076794

Cell: +267 77573849

Email: mafavuke2004@gmail.com

Supervisor:

Prof D.W. Govender

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4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Thank you for allowing your child to be part of this research.

DECLARATION

I..... (*Full name of participant*)
hereby confirm that I understand the contents of this document and the nature of the research study, and I consent for my child..... (*Name of child*) to participate in this research project. I understand that I am at liberty to withdraw him/her from the project at any time, should I so desire.

.....
SIGNATURE OF PARENT/ GUARDIAN DATE

**Appendix VII: Declaration of consent – permission from parents to allow their children
to be audio-recorded**



January 12, 2017

Dear Participant,

INFORMED CONSENT LETTER

My name is Mr. Kgalemelo Rodnie Mafa, a registered Master's learner at the College of Humanities: Faculty of Education (Computer Science Education) at the University of KwaZulu-Natal, Edgewood Campus, South Africa. I am carrying out a research study on the topic:

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The findings from the research will be useful for:

Teachers and administrators in schools to use mobile technology in teaching and learning to enhance academic achievement or learning.

The curriculum developers to effectively include mobile technology in school syllabuses as this can help increase results performance.

The Ministry of Education and Training, which legislates guidelines and policies for teaching and learning in schools, who will be made aware of other teaching methods which will help in bringing about a significant improvement in academic enhancement.

The teacher training institutions, which will be made aware of areas in which they need to improve their pedagogy related to technology, to ensure that teachers integrate e-learning effectively in education.

To achieve all of this I would like you to be part of the informants who will be responding by filling in a questionnaire with no intervention from anyone. Kindly note that attempts will be made as much as possible not to disrupt the day-to-day running of your lessons and the school.

Please note that:

Your privacy, anonymity, confidentiality and acknowledgement shall be upheld, your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.

The questionnaire can be completed in just 20 - 30 minutes.

Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.

Data will be stored in secure storage and destroyed after 5 years.

You have a choice to participate, not participate or stop participating in the research. Please note that you will not be penalized for taking such a decision.

Your involvement is purely for academic purposes, and there are no financial benefits involved.

If you are willing to participate in this study by completing the questionnaire, please complete the declaration at the end of this letter.

In the event of any problems or concerns/questions you may contact the researcher at the following contacts;

Researcher:

Mr. Kgalemelo Rodnie Mafa

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: Faculty of Education
Private Bag X03, Ashwood, 3605
Durban, South Africa
Learner ID no: 216076794
Cell: +267 77573849
Email: mafavuke2004@gmail.com

Supervisor:

Prof D.W. Govender

Discipline of Computer Science Education
School of Education (Edgewood Campus)
University of KwaZulu-Natal
Durban, South Africa
Tel.: 031 2603428/3455
Email: Govenderd50@ukzn.ac.za

Or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Thank you for being part of this research.

DECLARATION

I..... (*Full name of participant*)
hereby confirm that I understand the contents of this document and the nature of the research
study, and I consent for my child..... (*Name of child*) to participate in this
research project and to be audio-recorded. I understand that I am at liberty to withdraw
him/her from the project at any time, should I so desire.

.....
SIGNATURE OF PARENT/ GUARDIAN DATE

Appendix VIII: Letter of request to conduct research in Botswanan Senior Secondary

Schools



August 11, 2016

The Director
Ministry of Education and Skills Development
Private Bag 001
Gaborone, Botswana

Dear Sir/Madam,

RE: REQUEST TO CONDUCT RESEARCH STUDY IN SOME SENIOR SECONDARY SCHOOLS IN BOTSWANA

This is to request your permission to allow me to conduct a research study in the senior secondary schools in the South East inspectoral area of Botswana. The study is intended to be piloted in one senior secondary school, followed by the main research in 4 senior secondary schools in the South East inspectoral region. I am currently doing my Masters of Education in Computer Science education at the University of KwaZulu-Natal, South Africa.

Topic: The Use of Mobile Technology (Smartphones) in Teaching and Learning in Botswana Secondary Schools to Enhance Teaching and Learning

The purpose of this study is to investigate if there is a correlation between the use of mobile technology and enhanced learning, and to determine how mobile technology can be used to enhance academic achievement or learning.

The findings from the research will be useful for:

Teachers and administrators in schools to use mobile technology in teaching and learning to enhance academic achievement or learning.

The curriculum developers to effectively include mobile technology in the schools' syllabuses as this can help increase results performance.

The Ministry of Education and Training, which legislates guidelines and policies for teaching and learning in the schools, who will be made aware of other teaching methods which will help in bringing about a significant improvement in academic enhancement.

The teacher training institutions, which will be made aware of areas in which they need to improve their pedagogy related to technology, to ensure that teachers integrate e-learning effectively in education.

The study will involve the use of a questionnaire to be completed by teachers and learners: All responses will be treated in strict confidence. Piloting is intended to be carried out in the month of November 2016, while data collection for the study is intended to be carried out in January to March 2017.

I look forward to your positive response.

In the event of any problems or concerns/questions you may contact the researcher at the following contacts;

Researcher:

Mr. Kgalemelo Rodnie Mafa

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: Faculty of Education

Private Bag X03, Ashwood, 3605

Durban, South Africa

Learner ID no: 216076794

Cell: +267 77573849

Email: mafavuke2004@gmail.com

Supervisor:

Prof D.W. Govender

Discipline of Computer Science Education

School of Education (Edgewood Campus)

University of KwaZulu-Natal

Durban, South Africa

Tel.: 031 2603428/3455

Email: Govenderd50@ukzn.ac.za

Or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

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Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

cc: School Head – Gaborone Senior Secondary School

cc: School Head - Ledumang Senior Secondary School

Appendix IX: Permit to conduct a research study

TELEPHONE (027) 3655469
TELEX: 2944 THUTO BD
FAX: 3185167



MINISTRY OF EDUCATION
AND SKILLS DEVELOPMENT
PRIVATE BAG 005
GABORONE

REF: DPRS 7/1/5 XXII (34)

REPUBLIC OF BOTSWANA

04th October 2016

Kgalemelo R. Mafa
P O Box 1908 ABG Sebele
Gaborone

Dear Sir

RE: PERMIT TO CONDUCT A RESEARCH STUDY

This serves to grant you permission to conduct your study in the sampled areas in Botswana to address the following research objectives/questions /topic:

The use of mobile technology (smartphones) in teaching and learning in Botswana Secondary Schools.

It is of paramount importance to seek Assent and Consent from the Director of South East Region, School head, Teachers, and students of sampled Secondary School that you are going to collect data from. We hope that you will conduct your study as stated in your proposal and that you will adhere to research ethics. Failure to comply with the above stated, will result in immediate termination of the research permit. The validity of the permit is from 04TH October 2016 to 04th October 2017.

You are requested to submit a copy of your final report of the study as stated in the Research Guidelines (para 4.5 - 4.6, 2007) to the Ministry of Education and Skills Development, in the Department of Educational Planning and Research Services, Botswana.

Thank you.

Yours faithfully

Sir Wonder Masebola
For/Permanent Secretary



Appendix X: Application for ethics approval - for research with human participants

INFORMED CONSENT

Information Sheet and Consent to Participate in Research

Date: 13 January 2017

Greeting in the mighty name of Jesus Christ, our Lord and Savior.

My name is Kgalemelo Rodnie Mafa from the University of Kwazulu-Natal, I am a registered Master's learner at the College of Humanities: Faculty of Education (Computer Science Education), Edgewood Campus, South Africa and my email address is mafavuke2004@gmail.com and mobile line +267 77573849

You are being invited to consider participating in a study that involves research on the use of mobile technology (smartphones) in classroom teaching to enhance the quality of teaching and learning in Botswanan secondary schools. The aim and purpose of this research is to investigate if there is a correlation between the use of mobile technologies and enhanced learning, and to determine how mobile technology can be used to enhance academic achievement or learning. The study is expected to enroll eighty participants in total (40 males and 40 female learners) in and around the south region inspectorial area in Gaborone senior secondary school and Ledumang senior secondary school. It will involve the following procedures; answering a questionnaire, participating in an interview session and being tape recorded while you respond to the interview questions and some learners will be required to use smartphones in teaching and learning. The duration of your participation if you choose to enroll and remain in the study is expected to be one full school term.

The study may involve the following risks and/or discomforts; some learners will be tape recorded while participating in an interview, some will use mobile devices and some individuals might find it difficult to use the devices. We hope that the study will create the following benefits;

1. Teachers and administrators in schools to use mobile technology in teaching and learning to enhance academic achievement or learning.
2. The curriculum developers to effectively include mobile technology in school syllabuses, as this can help increase results performance.
3. The Ministry of Education and Training, which legislates guidelines and policies for teaching and learning in the schools; who will be made aware of other teaching methods which will help in bringing about a significant improvement in academic enhancement.
4. The teacher training institutions, which will be made aware of areas in which they need to improve their pedagogy related to technology, to ensure that teachers integrate e-learning effectively in education.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number_____).

In the event of any problems or concerns/questions you may contact the researcher at the following contacts;

Email: mafavuke2004@gmail.com

Mobile: +267 77573849

Or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Participation in this research is voluntary and you may withdraw participation at any point if you feel so, no one will be forced to participate. Please note that you will not be penalized for taking such a decision. In the event of refusal/withdrawal of participation the participants will not incur penalty or loss of treatment or other benefit to which they are normally entitled. Your involvement is purely for academic purposes, and there are no financial benefits involved by participating in this study.

Your privacy, anonymity, confidentiality and acknowledgement shall be upheld, your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion. Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only. Data will be stored in secure storage and destroyed after 5 years.

--

CONSENT (*edit as required*)

I (Name) have been informed about the study entitled the use of mobile technology (smartphones) in classroom teaching to enhance the quality of teaching and learning in Botswanan secondary schools by Mr Kgalemelo Rodnie Mafa. I understand the purpose and procedures of the study. I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

I have been informed about any available compensation or medical treatment if injury occurs to me as a result of study-related procedures.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at;

Email: mafavuke2004@gmail.com or

Mobile: +267 77573849

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557 - Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

I hereby provide consent to:

Audio-record my interview / focus group discussion YES / NO

Video-record my interview / focus group discussion YES / NO

Use of my photographs for research purposes YES / NO

Signature of Participant Date

Signature of Witness Date
(Where applicable)

Signature of Translator Date
(Where applicable)

Appendix XI: Ethics Approval from the University of KwaZulu-Natal



19 January 2017

Mr Kgalemelo Rodnie Mafa 216076794
School of Education
Edgewood Campus

Dear Mr Mafa

Protocol reference number: HSS/0013/017M

Project Title: The use of mobile technologies (smartphones) in Teaching and Learning in Botswana Secondary Schools to Enhance Teaching and Learning

Full Approval – Expedited Application

In response to your application received 19 December 2016, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Dr Shenuka Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

cc Supervisor: Dr DW Govender
cc. Academic Leader Research: Dr SB Khoza
cc. School Administrator: Ms Tyzer Khumalo

Humanities & Social Sciences Research Ethics Committee

Dr Shenuka Singh (Chair)

Westville Campus, Govan Mbeki Building

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Website: www.ukzn.ac.za



Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville