THE EFFECTS OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ON TEACHING AND MANAGEMENT OF CURRICULUM-RELATED ACTIVITIES: A CASE OF SECONDARY SCHOOLS IN THE GROOT LETABA CIRCUIT, MOPANI DISTRICT IN THE LIMPOPO PROVINCE

By

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ABSTRACT

This study seeks to investigate the availability and effects of Information Communications Technology (ICT) on teachers' ability to perform their duties in terms of teaching and of managing other curriculum-related activities in Groot Letaba Secondary Schools of the Mopani District, Limpopo Province.

A quantitative research approach was applied to conduct this research and a structured questionnaire was used to collect primary data from participants in twelve Groot Letaba Circuit secondary schools. Secondary data was collected from a variety of electronic and printed media and official documents from the Department of Basic Education's records.

The findings reveal that, with the exception of a TV, photocopier and laptop/desktop computer, there is a scarcity of ICT resources at schools for ICT integration, and that the teaching and curriculum administration functions of most teachers have been impacted negatively by a lack of ICT equipment and/or insufficient use of these ICT resources for those schools who have them. In addition, while some teachers had received some form of ICT training, it was evident that such training has had minimal impact on the abilities of teachers to use ICT in their teaching or their curriculum administration work. The findings also reveal that there is a host of factors that negatively influence teachers' readiness for, and confidence in, using ICT. These need to be dealt with by the various stakeholders including, and especially, the Department of Education and the school management and private partners.

Key concepts: Information Communications Technology (ICT), integration, secondary school, Internet, E-education, E-learning.

DECLARATION

I declare that **THE EFFECTS OF ICT ON TEACHING AND MANAGEMENT OF CURRICULUM RELATED ACTIVITIES: A CASE STUDY OF SECONDARY SCHOOLS IN THE GROOT LETABA CIRCUIT, MOPANI DISTRICT IN LIMPOPO PROVINCE** hereby submitted to the University of Limpopo, for the degree of Masters in Public Administration (Education Technology), has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged..

MATHEVULA MD (Mr) 9 March 2015

DEDICATION

In memory of my late father, Samson Fumani Mathevula who, though uneducated, always wanted to see the best in me, and to all teachers from diverse backgrounds, with little or no ICT knowledge at all, in particular those from underprivileged schools who have to grapple with the integration of new technology into their teaching. To my mom, Thalita Maabu Tauyetsoala (Mathevula), thank you for making me the man that I am. This report is exclusively dedicated to you.

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LIST OF SELECTED ABBREVIATIONS

AKU:	Aga Khan University
CAD:	Computer Aided Design
CAM:	Computer Aided Manufacturing
CCTV:	Closed Circuit Television
CE: ELM:	Certificate in Education: Educational Leadership and Management
CMC:	Computer Mediated Communication
CSIR:	Corporate Social Investment Responsibility
DoBE:	Department of Basic Education
DoE	Department of Education
DSTV:	Digital Satellite Television
ECD:	Electronic Communication Device
ELRA	Education Labour Relations Act
ELRC:	Education Labour Relations Council
EMIS:	Educational Management Information Systems
ESL	English as Second Language
FET:	Further Education and Training
FRSS:	Fast Response Survey System
GDP	gross domestic product
GET:	General Education and Training
IBM:	International Business Machines
ICASA:	Independent Communications Authority of South Africa
ICT:	Information Communications Technology
ISPA:	Internet Service Providers' Association (ISPA)
ISTE:	International Society for Technology in Education
IT:	Information Technology
ITU-R	International Telecommunications Union-Radio
LMS	Learning Management System
MPCC	Community Multipurpose Centre
NAPTO:	National Professional Teachers Organisation
NCS:	National Curriculum Statement
NCES:	National Centre for Education Statistics
NDP	National Development Plan

NEPA	National Education Policy Act
NETS-T:	National Educational Technology Standards for Teachers
NGO	Non-Governmental Organisation
NOF:	New Opportunities Fund
NQF	National Qualifications Framework
OBE:	Outcomes Based Education
OFSTED:	Office for Standards in Education, Children's Services and Skills
OLSET:	Open Learning Systems Education Trust
OTJ	On-the-job
PAIA:	Promotion of Access to Information Act
PPP:	Public Private Partnerships
SABC:	South African Broadcasting Corporation
SADTU:	South African Democratic Teachers' Union
SAIDE	South African Union for Distance Education
SAITIS:	South African Information Technology Industry Strategy
SASA	South African Schools Act
SITCE:	Strategy for Information and Communication Technology in Education
SMT:	School Management Team
SPSS:	Statistical Package for the Social Sciences
TLI:	Teacher Laptop Initiative
WWW	World Wide Web

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1 Introduction

The objective of this study is to analyse the availability and effects of ICT on teachers' ability to perform their duties in terms of teaching and of managing other curriculum-related activities. The chapter starts by sketching the background and motivation of the study. It proceeds with a statement of the research problem and the aims and objectives of the study. The research questions stemming from the objectives of the study, and key definitions, are presented and the significance of the study discussed. The chapter concludes with a brief outline of the structure of the study.

1.1 Background

In the second decade of the 21st century, the use of Information Communication Technologies (ICT) in schools in the information age remains a hotly contested issue worldwide. It is highly ironic that this should be so in an era of information technology (IT). The term Information Communication Technologies (ICT) as used in this research refers to the hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images), as well as related services (Evoh, 2007:1). There is no doubt that the uses and functions of ICT go far beyond those of computers and the Internet or even telephony. Perron, Taylor, Glass and Margerum-Leys (2010:67) describe the extent of the uses of ITCs:

> "Information and communication technologies (ICTs) are broadly defined as technologies used to convey, manipulate and store data by electronic means. This can include e-mail, SMS text messaging, video chat (e.g., Skype), and online social media (e.g., Facebook). It also includes all the different computing devices (e.g., laptop computers and smart phones) that carry out a wide range of communication and information functions. All these electronic tools constitute the "Information and communication technologies" (ICTs) and are used to convey, manipulate and store information" (Perron, et. al. 2010:67).

There is a wide variety of ICTs, but, owing to the fact that this research was conducted in a developing country, namely South Africa, where schools are struggling to get even the basic

infrastructure, the types of equipment that are the focus of this research are: computers (desktops, laptops), photocopy machines, data projectors, interactive whiteboards, Word Processing, Internet, digital cameras, television (TVs), CD/DVD Players, radios and tape recorders. Other or additional types of ICT type are referred to as and when the context requires.

Although ICTs are used by pockets of schools in developing countries, they are pervasive in developed countries and are considered integral to the efforts to build social, political and economic participation in developing countries (Perron, et al., 2010:67). The impact of the use of ICT on the quality of education, both world-wide and in a country like South Africa, cannot be overemphasised. Education in South Africa has undergone tremendous transformation over the past two decades (Isaacs, 2007:2). Central to this transformation has been a complete policy overhaul in the form of a new National Qualifications Framework for schools, based on the concept of Outcomes Based Education (OBE) (Isaacs, 2007:2). OBE requires teachers of the 21st century, among their various other roles, to be mediators of learning, interpreters of curriculum, administrators and managers, scholars, facilitators, experts, lifelong learners, designers of learning programmes and teaching materials, and subject specialists (National Curriculum Statement [NCS], 2003). Moreover, the designers of the National Curriculum Statement (NCS) consider the process of learning as important as the content, hence one of its critical outcomes envisages learners "who will be able to use science and technology effectively and critically, showing responsibility towards the environment and the health of others" (DoE, 2003). The ways in which teachers are required by the Department of Education (DoE) to teach, and the ways in which learners are expected to learn, have also changed drastically since 1994. These changes in the curriculum, outlined in the Department of Education's Policy Guidelines, have ushered in a new approach to teaching (DoE, 2003), although many teachers remain trapped in the past in terms of pedagogy, and continue to advocate strongly for a return to the past. In addition to curricular changes, other changes in the education system with regard to school governance and management, teacher professional development and pedagogy (Isaacs, 2007:2) have required resources to be made available to schools and districts by government; this is to realise the objective of providing telecommunication infrastructure for learning and teaching to enhance the quality of teaching, as well as for management and administrative capacity (DoE, 2003). The Department of Education has also acknowledged that the challenge of providing modern technologies to schools to enhance the quality of learning and teaching will require

significant financial and human resources investment (DOE, 2003). In many instances adequate infrastructure (such as security rooms for safekeeping of ICT equipment, electricity infrastructure etc.) has had to be put in place prior to the provision of these resources, in order to ensure optimal usage. Thus, in a bid to improve the quality of teaching and learning, government, in collaboration with the private sector, parastatals and non-governmental organisations (NGOs), has begun to provide resources, in particular Information Communications Technology (ICT), to those schools that have the basic infrastructure (South Africa, DoE, 2003). However, the use of these technologies by these schools remains a problem. In some schools some of the technology equipment that has been delivered remains in boxes, uninstalled and unutilised. A case in point is the school where the researcher teaches, where a large flatscreen TV has remained in its packaging since 2008, and a satellite dish remains uninstalled. In some schools computers are mainly used to play games by teachers in their "free time". It is my contention that, while the government's intentions and plans with regard to provision of ICT are without doubt commendable, implementation and utilisation of these technologies remains a critical challenge. In other words, the existence of the gap between provision of ICTs and the capacity of teachers and school management to utilise them present an important challenge for both education researchers and education planners.

1.2 Motivation

The research was motivated by the researcher's observation of many principals and teachers in secondary schools in the Mopani District, such as Magulasavi, Makheto and Chameti, who are supplied by the DoE with state-of-the-art ICT with the purpose of improving their performance both in management and in the classroom, and fail to make use of these, or do not use them effectively. The Department of Basic Education (DBE) defines a secondary school as "an institution that offers formal schooling from Grade 8 to Grade 12. An institution that offers only a selection of grades from Grade 8 to Grade 12 is also referred to as a secondary school" (The DBE, 2012:32, cited in Mathevula, 2013:9). Compounding the problem is the lack of knowledge and skills of these teachers and principals in the operation and use of ICT equipment (Herring, 2004). In cases where such capacity exists, such as at Masiza Secondary School, these technologies are either abused or used minimally and inappropriately, with no meaningful benefit derived in terms of improvement in management, curriculum resources or delivery. Tragically, schools such as Xihlomule have never received

ICTs, nor does the school management consider purchasing them themselves with the funds allocated by the Department. Mwalongo (2011)'s words give a captivating picture of this scenario:

> "In some schools there is a culture of looking at ICT resources as sacred objects. It is beyond human comprehension to learn that in some schools ICT resources are not used at all despite their presence, the availability of users and the need to use them" (Mwalonga, 2011:43).

It is hoped that the findings of this research could be useful in improving the provision and distribution of ICTs, but, most importantly, its use to enhance the performance, effectiveness and efficiency of teaching and learning in particular, and management of schools in general.

1.3 Statement of the problem

ICT use has been and remains in a state of fluidity (Isaacs, 2007:1). Its use and integration into the school curriculum remains significantly underdeveloped in developing countries (ibid). This situation is caused by many factors, amongst which are the ineffective or inefficient provision and installation of ICT (resources) in schools, lack of capacity in terms of lack of competence and confidence on the part of teachers and administrators, lack of basic infrastructure such as electricity, and other related factors (Bingimlas, 2009:235). This study seeks firstly to investigate the availability and accessibility of ICT equipment in participating secondary schools, secondly to analyse the impact of the use of ICT on teaching and learning, and finally to analyse the impact of training in ICT use and integration into the curriculum by teachers in secondary schools in selected schools of the Great Letaba circuit of the Mopani District in the Limpopo province of South Africa.

1.4 Aim of the study

The purpose of this study is to analyse the effects of ICT on teachers' ability to perform their duties in terms of teaching and of managing other curriculum-related activities. The study aims to demonstrate that substantial qualitative and quantitative improvements can be accomplished in secondary education through ICT utilisation.

1.5 Research objectives

- To investigate the presence of ICT in selected secondary schools in the Great Letaba Circuit, Mopani District in the Limpopo province.
- To analyse the frequency of use of ICT by teachers in teaching and learning.
- To analyse the effect of the use or non-use of technology by teachers and principals on teaching and learning in selected secondary schools.
- To analyse the impact of ICT training, or the lack of it, on teachers and principals with regard to ICT use.
- To analyse the factors hindering teachers' readiness and confidence in using ICT.
- To recommend strategies that could be used to improve the use of ICT in teaching and of managing curriculum related activities in secondary schools.

1.6 Research questions

- What types of ICT are present in secondary schools?
- What is the frequency of use of ICT by teachers in teaching and learning?
- What effect does the use of ICT have on teaching and learning?
- What effect does ICT training, or the lack of it, have on ICT use?
- What are the factors hindering teachers' readiness and confidence in using ICT?
- What strategies could be used to improve the use of ICT in teaching and of managing other curriculum-related activities in secondary schools?

1.7 Definition of key concepts

1.7.1 Information Communication Technologies (ICTs) consist of the hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images), as well as related services (Evoh, 2007:1).

1.7.2 ICT integration: Integration of ICT entails the combination of all technology parts, such as hardware and software, together with each subject-related area of curriculum to enhance learning (Shelly et al., 2008:327).

1.7.3 e- Education: The term "e-education" describes the items of equipment (hardware) and computer programmes (software) that allow us to access, retrieve, store, organise, manipulate and present information by electronic means. Personal computers,

scanners and digital cameras fit into the hardware category; database programmes and multimedia programmes fit into the software category (DoE, 2003).

1.7.4 Information literacy: This term means the ability to locate, evaluate, manipulate, manage and communicate information from different sources (DoE, 2003).

1.7.5 E-learning: The term refers to flexible learning using ICT resources, tools and applications (ICTs), and focuses on interaction among teachers, learners, the online environment and on collaborative learning. It also refers to structured and managed online learning experiences, and may involve the use of the Internet, CD-ROM, software, other media and telecommunications (DoE, 2003). E-learning comprises instructions delivered through all electronic media including the Internet, intranets, extranets, satellite broadcasts, audio/video tapes, interactive TV and CD-ROMS (Govindasamy, 2002).

1.7.6 Software: This refers to computer programs that provide instructions that enable tasks to be performed by the computer.

1.7.7 Hardware: This is a term used to describe electronic machines such as computers, monitors, printers, scanners, cameras etc. (Govindasamy, 2002).

1.7.8 Internet: This is the global communications network which enables computers to share information in an electronic form (*ibid*).

1.8 Significance of the study

The study is of value and importance to those in primary and secondary education in that it analyses the extent and use of technology by learners, teachers and principals and whether or not these affect teacher and learner performance. Improvement of teacher and learner performance both concerns and affects teachers and principals, parents, department officials and policy makers alike. It is hoped that this study will motivate teachers and principals to use ICT and to alter their perceptions regarding the use of ICT, with a view to improving both curriculum provision and delivery, and school administration. The findings of the research could assist the officials of the Department of Basic Education and policy makers to strengthen the delivery, provision and training of teachers and principals in South African schools with regard to ICT usage.

1.9 Outline of chapters

The following is an outline of the content of the chapters of the research:

Chapter 1 presents the context of the study, the reasons for undertaking the study, the aims and objectives of the study, the research questions and succinct definitions of key concepts used in the study.

Chapter 2 presents a literature review, indicates what is available on the use of ICT in education in the existing literature and any gaps in the literature. In the process the researcher will also indicate the relevance of the surveyed literature to the study.

Chapter 3 explains in detail the research methodology, the process involved in the sampling of the participants as well as the eliciting, capturing, analysing and interpreting the data. The chapter concludes with an assessment of the data collected, indicating the flaws, shortcomings, gaps and limitations of the data.

Chapter 4 deals with the analysis of the data or evidence collected. The researcher continues with the process of evaluation and assessment of the data analysed, and interprets the findings.

Chapter 5 presents the main conclusions in terms of the cited literature surveyed, and the results and findings of the research questions. It concludes with an assessment of whether/to what extent the aims and objectives of the research have been realised or not and recommendations for implementing ICT in schools, including the nature of ICT training for teachers.

1.10 Conclusion

This chapter initially deliberates on the rationale for undertaking the research. It then presents the motivation and aim of the study. The objectives for the study are given, followed by research questions directly derived from the research objectives. Definitions of key concepts pertaining to ICT are given to clarify possible misconception. It concludes by providing the significance of the study in education and an outline of all chapters of the study. The following chapter deals with the literature review.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Chapter 1 focussed on the background, rationale, aim and objectives of this research. This chapter will review the literature in order to discuss (1) the importance of ICT in education and (2) different types of information communication technology (ICT), different teaching and learning events and associated media forms, as well as the advantages of computers and the Internet in teaching and learning. The chapter will proceed with a discussion on the paradigm shift in teachers, the learners' role, competencies as a result of ICT use in schools, the future of textbooks in the ICT era, the challenges facing integration of ICT in secondary schools, some common stumbling blocks to successful ICT integration in schools and their proposed solutions, and ICT infrastructural challenges in South Africa. The reasons why ICT rollout initiatives in education fail will be analysed before the conclusion of this chapter.

2.2 Importance of the use of ICT in education

During the past decade a great deal of literature has been produced on the use of ICT in schools (Summak & Samancioglu, 2011; Isaacs, 2007; Goyal, Purohit & Bhaga, 2011). In addition to literature, there has been an exponential growth in the use of information and communication technology (ICT) in education in developed and developing countries (Allan, Yuen & Wong, 2003:158). For example, according to Kozma (2003:1), some national studies such as the one conducted in the USA found a negative relationship between the frequency of use of school computers and school achievement. Similar findings came from international data (Pelgrum & Plomp, 2002 in Kozma, 2003:1). However, according to Isaacs (2007:2), there is growing evidence to suggest that the use of ICTs may be the only feasible and economically sound means of expanding access to, and improving the quality of, secondary education in the short run. There are several rationales for the uptake of ICT in education, namely economic, social, vocational and pedagogic (Peter, 2010:10). Peter argues that the economic rationale of ICT in education relates to potential increase of efficiency and effectiveness in educational tasks, which will result in labour-saving costs. Pedagogic rationale on the other hand "emphasises the contribution that ICT can make to the improvement of the quality of education by providing rich, exciting and motivating and new environments for learning" (Peter, 2010:10). Last but not least, according to van Ark (2011:6)

and Peter (2010:10), social rationale focuses on the social aspects and benefits of ICT. There is a growing consensus that ICT utilisation and E-learning have serious implications for leaders and teachers, parents and pupils alike (Uhomoibhi, 2006:6). The Department of Basic Education (DoBE) also attests to the centrality of ICT in the transformation of education specifically, and to South African society in general (DoE, 2003). To this effect, the South African Department of Basic Education (DoE) contends that ICT tools are no longer luxuries to be enjoyed by a privileged few, but should be accessible to all South African learners (DoE, 2003a). Researchers such as Evoh (2007:8) argue that the deployment of ICT in secondary schools, including the training of teachers in the use of ICT, will enable South Africa to use limited resources, including teachers, more effectively to accomplish the goals of improved secondary education and human resource development.

However, while the use of ICT is expected to have far-reaching effects on the performance in many aspects of life (such as economic, pedagogic and social etc) (van Ark, 2011:6), the focus of this research is on how the use of ICT is expected to affect performance in education, with special reference to teaching and learning and curriculum management in secondary schools of the Groot Letaba Circuit in Limpopo, South Africa. The following are some types of ICT that can be used to improve learning and teaching.

2.3 Selected types of Information Communication Technology (ICT)

There has always been a misconception that Information Communication Technologies (ICTs) refer to computers and the Internet. Conventionally, communication technology referred to overhead, opaque and slide projection hardware, demonstration media, two-way radios, closed circuit television (CCTV), small format videos and open broadcast radio and television (TV) (Flor, 2008:30). However, there has been a change in this conception over the past 20 years or so. According to Flor (2008:30), “Today ICT encompasses personal computers (PCs), cellular telephony, imaging technology, cable television, digital photography and videography”. Other literature identifies a variety of ICTs as well (Farrell & Isaacs, 2009a). For example, Howie, Muller & Patterson (2005:7) argue that the scope of technologies range from first generation technologies to sophisticated third and fourth generation technologies. The first generation of wireless telephone technology (i.e. mobile telecommunications) are referred to as 1G (or 1-G). These 1G are the analogue telecommunications standards that were introduced in the 1980s and continued until being replaced by 2G digital telecommunications in the 1990s. The main difference between two

successive mobile telephone systems, 1G and 2G, is that the radio signals that 1G networks use are analogue, while 2G networks use digital signals. According to the International Telecommunications Union-Radio communications sector (ITU-R) (2002:1), 3G, short for third generation, is the third generation of mobile telecommunications technology. These 3G telecommunication networks support services that provide an information transfer rate of at least 200 kilobits per second (kbit/s). The 3G system finds application in wireless voice telephony, mobile Internet access, fixed wireless Internet access, video calls and mobile TV (ITU-R, 2002; see also http://en.wikipedia.org/wiki/3G). ITU-R (2002) also defines the 4G or *fourth generation* of mobile phone mobile communication technology standards as a successor to the third generation (3G) standards. A 4G system provides mobile ultra-broadband Internet access, for example to laptops with USB wireless modems, to smartphones and to other mobile devices ((ITU-R, 2002). Conceivable applications include amended mobile web access, IP (Internet Protocol) telephony, gaming services, high-definition mobile TV, video conferencing, 3Dimension (3D) television and cloud computing (ITU-R, 2002). Cloud computing is the Internet-based storage for files, applications and infrastructure (Mell & Grance, 2009:9). Peak speed requirements for 4G service is set at 100 megabits per second (Mbit/s) for high mobility communication (such as from trains and cars) and 1 gigabit per second (Gbit/s) for low mobility communication (such as pedestrians and stationary users) (see also http://en.wikipedia.org/wiki/4G, accessed: 2 December 2013). There is also talk of 5G (fifth generation mobile networks or fifth generation wireless systems). This 5G (also referred to as beyond 2020 mobile communications technologies) is a term used in some research papers and projects to denote the next major phase of mobile telecommunications standards beyond the current 4G standards (see also http://en.wikipedia.org/wiki/5G, accessed: 2 December 2013). Presently the term 5G does not describe any particular specification in any official document published by any telecommunication standardisation body (ITU-R, 2002).

These technologies range in turn from conventional gadgets, for example videos, audio tapes, radios and television, to modern state of the art technologies, such as computers and Smart-Phones (a mobile phone that is able to perform many of the functions of a computer, typically having a relatively large screen and an operating system capable of running general-purpose applications), from low end to high end (relatively inexpensive to relatively expensive of its kind respectively), from analog to digital (Flor, 2008:30).

The good news to learners and teachers alike is that, according to Kruger (2010:5), the use of "mobile learning tools" is expected to dominate other ICTs, while mobile technologies are expected to make a significant impact on education and learning and to provide interactive content in previously unreachable and remote locations". Similarly UNESCO (2012:13) contends that: "Mobile phones hold greater potential than personal computers (PCs) or laptops for educational use by significantly larger numbers of teachers in Africa and Middle East (AME) due to their widespread proliferation among teachers for personal use, including those in remote, socio-economically deprived areas". This is also the view held by the International Telecommunications Union (ITU) which states that, by the end of 2010, there were an estimated 5.3 billion mobile cellular subscriptions worldwide, including 940 million subscriptions to 3G services (ITU, 2010:1). Currently, according to the National Planning Commission (NPC), 2011:83), "over 90 percent of the world's population can access mobile networks, with three-quarters of mobile subscribers living in developing economies". As the NPC puts it: 'Cellular technology has allowed Africa to leapfrog the age of fixed line telephony, bringing affordable access to millions of people' (NPC, 2011:83). There is already evidence to prove that most people in rural areas of developing countries such as South Africa have more access to mobile phones (cellphones) than they have to computers. For example, according to the report provided by the South African Statistics in 2012, except for the Eastern Cape (11,9% in 2011); Limpopo Province (with about 12%) has the lowest percentage of households owning a computer (Statistics South Africa (StatsSA), 2012). Furthermore, the same report shows that while about 3 092 542 of the 14 450 161 South African households have access to computers, only 175 153 of the 1 418 102 Limpopo households have access to computers. That is, 88% (i.e. 1 242 949) of a total of 1 418 102 households neither own nor have access to computers in Limpopo Province. On the contrary, according to Statistics South Africa (StatsSA, 2012:16) 12 850 874 of the 14 450 161 South African households own or have access to cellphones, and 88,5% (i.e. 1 254 808 of the 1 418 102) of Limpopo residents have access to a cellphone. There is therefore no doubt that mobile phones (cellphones) are more accessible than computers in rural areas and that using cellphones could provide the easier and faster option of extending e-Learning services to schools, irrespective of whether they are in urban or rural or remote areas.

Unfortunately, despite the widespread availability of cellphones even in rural areas, many teachers are not aware of the potential of mobile phones in education (UNESCO, 2012:13). In addition, despite the relatively widespread proliferation of ICT and ICT applications among

teachers and learners (even in developing countries), there still exists a generalised conservatism toward the use of mobile phones by young people at school (UNESCO, 2012:25). This is because many schools bar learners from bringing mobile phones to school, some because of fear of abuse, others because of sheer ignorance of its educational potential (UNESCO, 2012:13). There are different ways in which mobile phones can be abused. UNESCO (2012:25) argues that students could use their mobile phones to send 'bullying' messages to other students, cheat on tests and exams using SMS messaging, and access harmful pornographic materials and sex chat rooms. These UNESCO reports have influenced South African teachers' perceptions of mobile phone use by their students and have led many educators to support the banning of mobile phones from schools (UNESCO, 2012:25) as can be seen in the following section.

2.3.1 Mobile phones for learning in South Africa

According to UNESCO (2012:17), "It is significant that most lesson plans and online curricula offered via mobile phones can only be accessed through Internet-enabled mobile phones that can download images." These types of phones are generally called High-End-User phones. Myers (2012:1) describes "high-end phones" as phones which generally have:

> "Dual-core processor (newest generation), 4G capable, High-res display with latest display technology (ex. Super AMOLED Plus, Super LCD; HD), 4+- inch display (screen size), 1080p HD video capture, High-quality camera, 1 GB of RAM or more, New version of Android (as of 2013, this would be version 2.3 or later)" (Myers, 2012:1).

Unfortunately, this Internet-enabled mobile is usually more costly than text-based messages. These higher costs and the necessity for a high-end mobile phone render content unavailable to the vast majority of teachers and learners, meaning that the role of mobile phones in supporting curriculum delivery is extremely limited at this stage (UNESCO, 2012:17). This situation can only change if smartphones and Internet connectivity were to become more widely available and affordable (UNESCO, 2012:17).

However, in spite of such negativity associated with ICT in education, mobile phones have been used more recently for learning in many countries, including South Africa. According to Kruger (2010:6), one of the reported advantages is that mobile learning or phones, unlike

desktop PCs, enable users to perform any function while moving around. Additionally, mobile learning greatly alleviates the physical strain caused by school bags (ibid). Kruger (2010:6) further argues that mobile learning greatly reduces the costs of infrastructure for it does not require the facilities that traditional classroom learning requires. In South Africa, for example, there has been the piloting of Mathematics on MXit (a free online mobile instant messenger and social network developed by Mxit Lifestyle (Pty) Ltd. in South Africa which is pronounced as "mix it") (Beyers, Blignaut & Herselman 2012:114). Mxit runs on multiple mobile and computing platforms. The mobile education programmes delivered on the Mxit platform are also referred to as MobiEd programmes by the Meraka Institute (Farrell & Isaacs, 2009a:18). According to Beyers et al, 2012:117) “MXit IM, a next-generation mobile instant messenger and social networking software application, allows users to chat anywhere from a mobile phone or PC at no charge, using Yahoo, ICQ, Google Talk, AIM or Windows Live Messenger contacts” (MXit 2009, cited in Beyers, et al, 2012:117).

These authors further argue that “MXit and MetaLAB (2011) are striving to ensure that appropriate educational content and services are made as widely available as possible, at no charge to the end user, across Africa and beyond, via MXit’s mobile instant messaging channel (IM) (MXit 2009; metaLAB, 2011, as cited in Beyers, et al, 2012:117). In order to counteract the issue of cost, free access is supported by South Africa’s three local mobile network operators (Vodacom, Telkom and MTN) (UNESCO, 2012:20).

Another dedicated website using Moodle (an open-source LMS or Learning Management System with a mobile interface) has also been developed to complement the mobile platform. This website has the benefit of allowing students and teachers to use their mobile phones to track progress and activities on the web (UNESCO, 2012:20). According to Naidoo (2011), the site also allows teachers to assign and monitor homework with little extra effort. In addition, the system makes it easy for teachers to see which students are having problems and to identify areas that are causing difficulties. The teachers can also use the exercises and theory lessons in a classroom even if the students do not have mobile phones, and make use of the tests to develop ad hoc exams (Naidoo, 2011).

The fact that Mxit provides access to educational content at no cost to the end-users (in this case students and teachers across the African continent) provides an added advantage and motivation to using mobile technology in education in these countries. However, although mobile phones have profound educational potential, there are impediments that are worth

noting. Chief among these impediments are the higher cost and the need for "high-end mobile phones" as the following paragraphs show.

2.4 Teaching and learning events and associated media forms

Bahati (2010:10) argues that the efficacy of ICT integration in the classroom "is related to the way teaching events are thoroughly related to their corresponding learning events, the associated media forms with their corresponding computer and non-computer based activities". The purpose of ICT is to assist teachers by providing them with different forms of resources which can be used to support different learning approaches (Vermeulen, 2007:11). Supplying technology-based resources to schools is not a universal remedy. Therefore, educational technology-based resources should be appropriately matched to both teaching and learning activities to ensure maximum efficiency (Laurillard, 2002). This is also the view held by Newton & Rogers (2001:140), who argue that the success of teaching with ICT is dependent on the quality of the match between the learning purpose and the selected teaching approach. The following table indicates the different learning and teaching activities and various media forms (ICT's) associated with these activities (Jaffer, Ng'ambi & Czerniewicz, 2007).

Table 1: Teaching and learning events and associated media forms

Teaching/ Learning event	Teaching action or strategy	Learning action or experience	Related media form	Examples of non-computer based activity	Example of computer based activity
Acquisition	Show, demonstrate, describe, explain	Attending, apprehending, listening	**Narrative** Linear presentational Usually same 'text' acquired simultaneously by many people	TV, video, film, lectures, books, other print publication	Lecture notes online, streaming videos of lectures, DVD, multimedia including digital video, audio clips and animations
Discovery	Create or set up or find or guide through discovery spaces and resources	Investigating, exploring, browsing, searching	**Interactive** Non-linear presentational Searchable, filterable etc., but no feedback	Libraries, galleries, museums	CD-based DVD, or Web resources including hypertext, enhanced hypermedia resources. Also information gateways
Dialogue	Set up, frame, moderate, lead, facilitate discussions	Discussing, collaborating, reflecting, arguing, analysing, sharing	**Communicative** Conversation with other students, lecturer or self	Seminars, tutorials, Conferences	Email, discussion forums, blogs
Practice	Model	Experimenting, practising, repeating, feedback	**Adaptive** Feedback, learner control	Laboratory, field trip, simulation, role play	Drill and practice, tutorial programmes, simulations, virtual environments
Creation	Facilitating	Articulating,	**Productive** learner	Essay, object,	Simple existing tools, as well as

		experimenting, making, synthesising	control	animation, model	especially created programmable software

Jaffer, Ng'ambi & Czerniewicz (2007), taken from Czerniewicz & Brown (2005)

To summarise, the table above indicates how ICT and pedagogy can be systematically integrated in a more comprehensive and meaningful way in the classroom (Bahati, 2010:10). Learners learn differently and so teaching activities should be organised accordingly. A summary of the media types and the areas in which they are likely to have maximum impact follows.

2.4.1 Media types and their likely high-impact subjects areas

Research has shown that different types of ICT will have maximum benefits if used correctly within the curriculum. However, while ICTs have an immense potential to improve the quality of education by supporting teaching and learning in the classroom (South Africa, DoE: 2003), it is also important to choose the right medium in order to maximise the benefits of teaching and learning. For example, studies such as the one conducted by Wenglinski (1998), found that certain uses of technology had a positive effect on learners/students' achievement in different school grades. In the fourth grade, for example, according to Kozma (2003:1), the use of computers for learning games was positively related to mathematics achievement. In the eighth grade, the teacher's professional development in the use of ICT and its use to teach higher-order thinking skills were the ones positively related to the learners' mathematical achievement (ibid). More recently, analysis of US data "has shown a positive relationship between science achievement and the use of computer learning games in the fourth grade, the use of simulations in the eighth grade, and the use of computers to collect, download and analyse data in the twelfth grade" (NCES, 2001, cited in Kozma 2003:1). According to Passey and Rogers (2004:37), the following are just some of the examples of media that are likely to have the most motivational impacts if used in these subject areas.

Table 2: Media type and likely high-impact subjects areas

Media type	**Subject areas**
Mathematics	interactive whiteboard, presentational software, Illinois Learning Standard (ILS), interactive courses
English	word processing, Internet, interactive whiteboard
Science	interactive whiteboard, simulation and modelling software
ICT	Internet, interactive whiteboard

Design and technology	3D design modelling software, Computer-Aided Design (CAD)/Computer-Aided Manufacturing (CAM) software, email, Internet, subject specific software, digital cameras, scanners,, interactive whiteboard, presentational software
Geography	Interactive whiteboard
History	Interactive whiteboard
Modern foreign languages	Presentational software, audio cassettes
Art and design	Interactive whiteboard, Internet

Table created by the researcher, based on Passey & Rogers (2004:37).

Furthermore, as argued by Bransford, Brown and Cocking (2000), the positive impact of technology does not come automatically; much depends on how teachers use ICT in their classes. Research done in the UK has, for example, found a number of *sine qua non* factors that are necessary for the use of ICT to have high impacts on teaching and learning. These factors include teachers' ICT skills and dedication, teachers' preparedness and subject knowledge, and a number of certain specific teaching strategies. Thus, according to the evaluation report into ICT usage in England of the Office for Standards in Education, Children's Services and Skills (Ofsted, 2011:12), using ICT in teaching was considered to be "good or outstanding" when:

- "well-judged pace was sustained throughout the lesson, with effective strategies for maintaining all pupils' engagement at a high level, even through periods of time when data needed to be uploaded or equipment had to be changed,
- teachers had excellent subject knowledge and teaching assistants were well informed and briefed,
- consistent attention was paid to reinforcing pupils' understanding and their use of key words,
- planning was thorough and detailed, with particular attention to meeting the different requirements of individual pupils,
- clear and explicit learning objectives were proposed and then discussed with pupils and displayed throughout the lesson,
- safe working was emphasised at all times and with all resources,
- a range of equipment and resources was available wherever pupils were learning, including laptops, cameras, recorders and alternative operating systems,

- excellent use was made of interactive whiteboards to summarise and review in a fast-paced manner, and to introduce new learning in a highly motivating, stimulating format,
- opportunities were available for pupils to experience ”real world” ICT use outside school,
- teachers encouraged pupils to be independent and to make sensible choices about appropriate equipment and materials for their task,
- questions were used skilfully to challenge and extend learning,
- formative assessment, through a variety of means, was an integral part of each lesson, while self- and peer-assessment were actively promoted,
- explicit links were made with key learning points in other subjects and most especially in literacy and numeracy” (Ofsted, 2011:12).

Based on these findings, a combination of the teachers' mastery of the subjects being taught, the teachers' ICT competency and their ability to use ICT equipment to deliver the lessons, but also the availability of a variety of ICT equipment to match the subjects being taught at schools are crucial factors, if the use of ICT is going to have an impact on teaching and learning in South Africa.

Some of the advantages of computers and the Internet for teaching and learning follow.

2.5 General uses of computers and the Internet in teaching and learning

ICT equipment such as computers tends to have general usage in education and in teaching and learning. Stevenson (1997:13) provides a useful list on how computers may be used in schools. This list is no way exhaustive. First and foremost, Stevenson (1997:13) argues that ICT can be used to administer schools; secondly, to train students in skills which they will need in further education and on-going learning for the rest of their lives and for their future jobs, such as word processing, computer programming, etc. Thirdly, ICT can be used to provide access to information and communication outside the classroom walls, such as video conferencing with students in other countries, using the Internet. Fourthly, ICT can be used to support teacher development through external networks. Lastly, ICT can be used to support and potentially transform the learning/teaching process in many and diverse ways. This

elucidation highlights the loud and persistent call by policy makers and private companies alike to integrate computers into education in general and teaching and learning in particular.

The following paragraphs elaborate on some selected general use of computers in education.

2.5.1 Administration of schools

School administration is a key determinant for the realisation of desired outcomes and success in both public and private schools, hence is seen as critical by all stakeholders (Makewa et al, 2013:48). However, some authors such as Balanskat (2007:32) argue that there is no conclusive evidence that shows that ICT does indeed make the work of teachers less time-consuming. This is contrary to Uhomoibhi (2006:8), who argues that the advantages of using ICTs must by far outweigh the disadvantages for its implementation to be worthwhile. This is also contrary to Makewa et al. (2013:48) whose study investigated whether there was a significant difference between Kenyan teachers' and administrators' perceptions of the importance of Information and Communications Technologies (ICT) in secondary school administration after evaluating the extent to which it was used by administrators (i.e. those involved in the day-to-day running of secondary school duties such as the principal, deputy principal and heads of departments), these authors concluded that "Both teachers and administrators rated the use of ICT in secondary school administration as important". The same study also found that "Teachers and administrators viewed the use of ICT in student administration as equally important and that administrators rated the importance of using ICT in supervision of instruction and in student administration more highly" (Makewa et al, 2013:48).

Consequently, an increasing number of schools (especially in developed countries) have incorporated ICT into management tasks (Balanskat, 2007:38). According to Balanskat (2007:34), about 93% of schools have incorporated ICT into these. In fact, the same study found that "Management teams have high expectations of the usefulness and effectiveness of ICT for these tasks (in 89,3% of cases)." According to Maki (2008) in Makewa et al, 2013:53)'s study in Cyprus secondary schools, administrative subsystems include personnel administration, student administration, resource administration, financial administration and general administration. Teachers are increasingly using ICT for administration and planning. Furthermore, ICT makes administration more "accessible to wider groups through a web interface and school records are more easily maintained, exchanged and updated" (Balanskat,

2007:38). According to Prince (2007:23), computers are used for administrative purposes by administrative, managerial and teaching staff members. Some of the administrative activities that may need the use of computers include inter alia:

> "Typing and printing of official documents, lesson plans and worksheets; designing and typing other documents (such as school reports, timetables, tests); creating a database of teachers and pupils; creating spreadsheets for maintaining the school budget; and for keeping records of assessments. If Internet connectivity is available, computers can also be used for reading and responding to official e-mail messages and for creating and maintaining the official school website" *(*Balanskat, 2007:23).

A point of note is that, teachers and principals themselves record a positive impact of ICTs, particularly the computer, to all aspects of administration (Miller, Naidoo & Van Belle, 2006:7). Some of the positive outcomes cited for using ICTs as an administrative tool include, amongst others, "the saving of time doing administrative duties, for example calculating totals and averages for learners' marks and neater and better organisation of administration" (Miller et al, 2006:7). There is no doubt that using computers to calculate marks reduces the human error factor, thus increasing accuracy in the calculation of students' marks. The use of ICTs in better organising administration may also raise the overall quality of education. This is because using ICT to do school administration work allows teachers to spend less time on administrative tasks and concentrate more time on teaching and learning (Cairncross & Poysti, 2003:8).

2.5.2 Communication

ICTs, in particular computers and the Internet, play a vital and radical role in taking the educational environment, particularly research, to more globally acceptable levels through information sharing and collaboration (Kruger, 2010:3). Through the use of the Internet, students are able to interact with fellow students and exchange valuable information. Salmon, as quoted by Kruger (2010:3), has developed a model that serves as a guide to telelearning. The term "Telelearning" as applied here relates to "making connections among people and resources, via communication technologies, for learning-related purposes" (Moonen, 1997:68*)*. As learners engage in telelearning they receive:

- "Online socialisation: Sending and receiving messages and networking with the other students and teachers.
- Information Exchange: Searching and personalising software. Exchanging information between students and getting information from the Internet
- Knowledge conferencing: Discussing collaboratively relevant topics and sharing of experience and knowledge.
- Development: Providing links outside conferences. Developing via interacting with the teacher and other students to help them reach their learning goals. The teacher has a very important role to play in the learning of the student" (Kruger, 2010: 6).

From the foregoing it is quite evident that ICTs are a vital communication tool in the hands of both teachers and learners of secondary schools, if fully utilised. This is, for example, confirmed by the Nordic study on e-learning conducted by Ramboll, (2006), cited in Balanskat, (2007:32) in Copenhagen, Denmark, which found that the impact of ICT on knowledge-sharing is more prevalent in secondary schools than in primary schools. This study found that 84% of secondary school teachers use ICT daily or weekly to communicate with colleagues and that 57% of them have used them in teacher-pupil communication. There was, however a concern related to the fact that, in spite of widespread availability of both public websites (homepages), intranets, Learning Management Systems and e-mail, primary school stakeholders – teachers, pupils and parents – report only moderate organisational impact and fewer benefits in daily activities and communication with each other. The same study found that "Only one in three secondary school teachers find that ICT has significantly helped in ensuring that pupils receive important information about planned activities (e.g. homework assignments or excursions" (Balanskat, 2007:32). Such moderate organisational impact and fewer benefits in daily activities were explained by the fact that "Nordic schools in Copenhagen, Denmark have only just begun in the last few years to purchase intranets and learning management systems" (ibid). According to Balanskat, (2007:32), developing routines for the use of these systems, moving from one-way information distribution to a shared collaborative platform, takes at least several years.

2.5.3 Support teacher development

ICT is an important tool for the professional development of teachers (Balanskat, 2007:24). According to Oladosu (2012:47), Information and Communication Technology has enhanced

teachers' professional knowledge, skill and capabilities by extending their subject knowledge, enabling planning and preparation for teaching to be more efficient. An example of how ICT is used for teacher development is that of Aga Khan University (AKU), an international university with locations in eight countries, including Kenya and Tanzania. According to UNESCO (2012:17), the university offers a certified course for student-teachers based on a blended model of face-to-face and practicum sessions. The course forms part of the Certificate in Education: Educational Leadership and Management (CE: ELM) programme based at AKU's teaching site in Kisumu, Kenya. Because of the low level of access to computers in Kenya's secondary schools, the course relies on the availability of student-teachers' personal mobile phones, which are used to support course delivery using an SMS system. Instructors send SMS messages to student-teachers, who can text replies using their mobile phones. Students are also grouped in clusters to enable SMS conversations that facilitate peer support (UNESCO, 2012). Similar programme such as SchoolNet SA and INTEL Teach exist in South Africa. SchoolNet SA provides online, mentor-based in-service training to teachers to introduce ICT into the curriculum and management (DoE, 2004). INTEL Teach provides teacher training in ICT integration into teaching and learning to the teacher development programme (DoE, 2004).

2.6 The positive impact of ICT in teaching and learning

There are some, such as Newton and Rogers (2001:18), who argue that even after some years of ICT utilisation and research into its effects, there is still some uncertainty over the merits of educational use. Firstly, there is a danger that students may be confused by the multiplicity of available information from which to choose (Mikre, 2011:13). Secondly, the prevalence of undesirable websites poses a real threat (Devadason, 2010a:14). The prevalence of undesirable websites is a critical concern that could affect learning and teaching because the teacher has to spend much time trying to control students from using websites unrelated to the learning content, instead of teaching (Mikre, 2011:13). Furthermore, learners may spend time surfing websites that show pornographic material as they seek to explore the Internet. These challenges bring into question the issue of security, not in terms of physical security – but in terms of access to information security. Thirdly, the openness of the web puts students into an exploratory mode which often challenges effective learning in time-constrained formal school systems (Devadason, 2010b:14). As a result students tend to misuse the technology for leisure time activities and have less time to learn and study (Mikre, 2011:12).

Yousef and Dahmani (as quoted by Mikre, 2011:12) describe online gaming, use of Facebook, chat rooms and other communication channels as perceived drawbacks of ICT use in education, because students easily switch to these sites at the expense of their study. It is also possible that the use of ICT may affect students' behaviour. Mikre (2011:13) identifies the following major limitations of ICT use in education as related to student behaviour:

- "Computers limit students,
- Over-reliance on ICT limits students' critical thinking and analytical skills,
- Students often have only a superficial understanding of the information they download,
- Computer-based learning has negative physical side-effects such as vision problems,
- Students may be easily distracted from their learning and may visit unwanted sites,
- Students tend to neglect learning resources other than the computer and the Internet,
- Students tend to focus on superficial presentations and copy from the Internet,
- Students may have less opportunity to use oral skills and hand writing,
- Use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher" (Mikre, 2011:13).

However, in as much as ICTs have innumerable benefits, there are disadvantages or threats that must be equally checked and properly managed in order to ensure its maximum uptake, utilisation and benefits, for both teachers and learners. If the disadvantages are left unchecked, they may outweigh the advantages (Mikre, 2011:13). However, despite such negative views about the effectiveness of using ICT for the purpose of teaching and learning, there has been an increasing amount of research conducted to investigate the impact of ICT in teaching and learning (Newhouse, 2002:17). An analysis of this literature shows widespread consensus about the positive impact of ICT among teachers (Balanskat, 2007:16). Balanskat (2007:16)'s study found that 79% of teachers believe that using computers in class has a significant impact on learning, while only 21% of them believe it does not. However, it is Kulik's (1994) research findings (quoted by Mikre, 2011:3) which provides arguably the best summary of impact of ICT usage in teaching and learning. Kulik's research findings show that students who used computer tutorials in mathematics, natural science, and social science score significantly higher on tests in these subjects. Students who used simulation software in science also scored higher. The findings also indicated that:

> "primary school students who used tutorial software in reading scored significantly higher on reading scores. Very young students who used computers to write their own stories scored significantly higher on measures of reading skill. Moreover, students who used word processors or otherwise used the computer for writing scored higher on measures of writing skill. Furthermore, the use of ICTs in education also shifts the learning approaches" (Kulik, 1994:9-34, also cited in Mikre, 2011:3).

The argument above is corroborated by Balanskat (2007:17) whose study found that about 87% of teachers believe ICT has observable benefits. Balanskat (2007:17) further argues that if ICT's are appropriately integrated, they will have a positive impact on teaching and learning.

Benefits from the utilisation of ICT in teaching and learning have been reported by other researchers such as Newman (2002:25) and Wheeler (2000). According to Wheeler (2000:2), ICT will bring about several benefits to the learner and the teacher if used effectively. These benefits, as Wheeler (2000:2) puts it, include shared learning resources, shared learning spaces, the promotion of collaborative learning and the move towards autonomous learning. In terms of sharing learning resources, according to Wheeler (2000), ICT will enable students and teachers to use video systems to transmit television programmes and information throughout an entire school and even between schools in the same district. Sharing resources has the potential of minimising costs and improving the quality of teaching and learning, especially in under-resourced schools. In terms of "Shared learning spaces" as Wheeler (2000:2) continues to argue, networked computing facilities create a distributed environment where learners can share work spaces, communicate with each other and their teachers in text form, and access a wide variety of resources from internal and external databases via web-based systems through the Internet. In terms of "Promoting of collaborative learning", Riel (2000:9, cited in Wheeler 2000:2), argues that much of what we now see as individual learning will change to become collaborative in nature. According to Wheeler (2000), schools in the UK are already starting to use discussion lists and other forms of computer-mediated communication (CMC) to promote collaboration in a variety of learning tasks and group projects. Furthermore, in terms of ICT facilitating the move towards autonomous learning, according to Wheeler (2000) computers – and the power they bring to the student to access, manipulate, modify, store and retrieve information – will promote greater autonomy in learning. In turn, such students' learning autonomy will enable children to exert more choice

over how they approach study, requiring less direction from teachers. Obviously, as argued later in this research (see section 2.7: paradigm shift in teachers and the learners' role), as students become increasingly able to direct their own studies to a greater extent, the teacher's role will become more and more "a guide or moderator rather than as a director" (Forsyth, 1996:31).

Furthermore, computers are seen as excellent technologies for drill and practice (Beyers, 2000:52). Kruger & Muller (1988:103) further attest that the multifaceted benefits of using ICTs include that they motivate pupils, provide variety, compensate for language deficiency, encourage active participation, reinforce learning, increase application possibilities, enhance the applicability of the learning content provided for the learning needs of individuals pupils, and supplement the spoken word. There is therefore no doubt that, if used correctly and in the right context and subject matter, technology can motivate learners in various ways, by capturing and holding their attention and providing unique, effective and powerful opportunities for teaching and learning (Shelly et al, 2008:11).

Finally, other benefits of ICTs include that they can act as an agent for change (Beyers, 2000:52). ICT has the added potential to significantly enhance educational reform by enabling teachers and learners to move away from traditional to more innovative and effective approaches to teaching and learning (DoE, 2003). They can also be employed to facilitate the transformation process of addressing unequal distribution of resources from the past (Beyers, 2000:52). A careful deployment of old and new ICTs can go a long way in bridging both the quantitative (access) and qualitative (standard) gaps in secondary education (Evoh, 2007:10). ICTs are used to make education accessible to more learners (Evoh, 2007:11). The deployment of old ICTs such as radio and television, and the new technologies such as computer, Internet connectivity and satellite imaging can expand the options of engaging in teaching and learning at individual, community and societal levels (UNESCO, 2012). The deployment of ICTs in secondary schools, including training of teachers in the use of ICTs, could, for example, enable South Africa (a country with huge inequalities between the rich and the poor, between the rural and urban areas' access to services, especially ICT) to use limited resources, including teachers, more effectively to accomplish the goals of improved secondary education and human resource development (Evoh, 2007:8). The importance of better utilisation of ICT resources is aptly summed up by Beyers (2000) in his argument that schools with one PC must be shown how to use their meagre resources more

effectively while schools with more resources must be empowered to remove the control of these resources from the computer science departments so that more learners can benefit (Beyers, 2000:52).

In South Africa, the Department of Education is committed not only to bridging the digital divide (i.e. a situation in which some people have access to ICTs and others have very little or no access at all), but also to adequately prepare its learners to lead productive lives in the global society (Gillwald, Moyo & Stork, 2012). A good summary of the positive impact of ICT on learning through the learning environment is provided by Newhouse (2002:6) in the following table.

Table 3: Positive impact of ICT on learning through learning environment

Positive impact of ICT	Examples of supporting research
Investigate reality and build knowledge.	In Canada research results point to the "transition from closed to open teaching and learning environments" (Laferriere et al., 1999). Students using the CSILE application showed gains on measures of depth of understanding and reflection (Scardamalia & Bereiter, 1996). Students use ICT to analyse, organise and creatively represent real information in constructing knowledge (Scardamalia & Bereiter, 1996)
Promote active learning and authentic assessment.	An evaluation of IMMEX Teacher Institutes have shown statistically significant improvement in teacher preparation to: manage a class of students who are using hands-on/laboratory activities, use a variety of assessment strategies, use performance-based assessment (WestEd, 1998). Students using the CSILE application showed gains on measures of progressive thought and reflection (Scardamalia & Bereiter, 1996). ICT may be used to support students to design and produce their own knowledge representations and thereby engage with powerful learning experiences (Berge & Collins, 1998). The evaluation of learning outcomes requires methods that measure understanding. These can be supported by the use of ICT (Brown, 1994).
Engage students by motivation and challenge.	Students have more positive attitudes towards their classes and learning when ICT use is included (Baker, Gearhart, & Herman, 1994; Kulik, 1994). The use of ICT has consistently improved students' attitudes towards learning and their own self-concept (Sivin-Kachala, 1998). Educational technology has had positive effects on student attitudes toward learning and on student self-concepts. Evidence of such is strongest in language arts, mathematics, science, and telecommunication/video technologies (The Software Information Industry Association., 1999). Content-related graphics (both static and animated) and video can help improve student attitudes and motivation in mathematics and science (The Software Information Industry Association, 1999).
Provide tools to increase student productivity.	Students tend to complete more in less time when they use ICT (Kulik, 1994). Students using an integrated learning system to support the development of skills in spelling, vocabulary, reading and mathematics showed improvements more cost effective than other major initiatives (Mann et. al., 1999).
Provide scaffolding to support higher level thinking.	It appears that appropriate use of ICT results in new learning experiences requiring higher levels of thinking and problem-solving (Baker et al, 1994). Animation and video can enhance learning when the skills or concepts to be learned involve motion or action (The Software Information Industry Association., 1999). Canadian students using portable computers created portfolios that demonstrated "advanced technology, inquiry, and meta-cognitive skills as well as deep understanding of a number of topics" (Laferriere et al, 1999). An evaluation of IMMEX Teacher Institutes has shown statistically significant improvement in teacher knowledge and use of problem-solving strategies in the classroom and present

	applications of concepts (WestEd, 1998). Students used simulation and cognitive support software to show improvement in higher order mathematical thinking (Wenglinsky, 1998).
Increase learner independence.	Foreign language and ESL (English as a Second Language) students can benefit from presentation of video segments with captioning (i.e. subtitles in the target language) (The Software Information Industry Association., 1999). Students using the CSILE application showed significant improvement in independent thinking (Scardamalia & Bereiter, 1996).
Increase collaboration and cooperation.	In courses using computer-based networks, many students who seldom participated in face-to-face class discussions became more active participants' online (The Software Information Industry Association., 1999). Introducing technology into the learning environment has been shown to make learning more student-centred, to encourage cooperative learning, and to stimulate increased teacher/student interaction (The Software Information Industry Association., 1999). An evaluation of IMMEX Teacher Institutes has shown statistically significant improvement in teacher preparation to use cooperative learning groups (WestEd, 1998). The use of ICT encourages teachers to use more cooperative work and fewer teachers lecturing (Baker et al., 1994). It plays a role in addressing language impairment (Turners Pearson, 1999).
Tailor learning to the learner.	Students who are field-independent learners (i.e. learners who rely less on contextual clues in defining meaning) perform better than field-dependent learners when using hypertext (The Software Information Industry Association., 1999). An evaluation of IMMEX Teacher Institutes have shown statistically significant improvement in teacher preparation to teach groups that are heterogeneous in ability and take students' prior conceptions into account when planning curriculum and instruction (WestEd, 1998).
Overcome physical disabilities.	There are many case studies where children with physical disabilities may use adaptive technologies to maximise their successful use of ICT (Donegan, 1999).

Source: Table adapted from Newhouse (2002:6)

The summary in this table highlights firstly the positive impact that ICT has on teaching and learning. Secondly, it highlights different researches and findings conducted world-wide that outline the positive impact of ICT on teaching and learning. Following is a discussion of how ICT is expected to change the role of teachers and learners in education.

2.7 Paradigm shift in teachers and the learners' role

According to Beyers our current education system favours information transfer as a form of training and does very little to address issues such as critical and lateral thinking or problem solving (2000:52). There is therefore an expectation that ICT would address some of the shortcomings of our previous education system. This is the view held by Beyers (2000) who argues that any form of ICT employed should begin to prioritise the transference of these kinds of skills. Some researchers, such as Keijo (2011:39), contend that the introduction of ICT has had a profound consequence on instructional activities in the teaching process and has changed the way students learn, but also, simultaneously, ICT has changed how teachers teach. ICT has had an impact on school as a physical learning environment (Keijo, 2011:39). ICT is also making major differences in the instructional approaches and the ways students

learn (Mikre, 2011:14). ICT is a mediator of this learning as a component of the learning environment (Chan, 2003:20). The focus is therefore, not on the technology to be employed, but on the objectives to be fulfilled by the use of the technology. Shelly et al (2008:11) argue that today's educators must provide students with the skills they will need to excel in a technology-rich society. They further argue that teachers themselves "are beginning to recognise that they must teach students … using current technologies so that these students will be comfortable using future technologies" (Shelly et al, 2008:11). Therefore, while the use of ICT in teaching and learning is increasingly becoming an obligation; "computers or computer-related resources cannot compensate for poor teaching" (Bialobrzeska & Cohen, 2005:23; Amedzo, 2007:8). Beyers (2000:51) agrees that there is an acute and critical need to transform educational methodologies that are relevant and to prepare students for the real world of the future. It is difficult to imagine how a teacher who does not know how to use technology can teach learners how to use it or convince them that it is important to their own development! The following paragraph discusses the new role of teachers and the paradigm shift in teachers' competencies in the ICT-driven learning environment.

2.7.1 The new role of teachers in the ICT-driven learning environment: A constructivism paradigm

The term "Constructivism" is defined by the Educational Broadcasting Corporation (n.d:1) as "a theory that says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences". The "Constructivism" theory implements the conception of student-centred approaches to teaching and learning, an approach that strives to break a long tradition of a traditional and teacher-centred approach and knowledge transfer (Keijo, 2011:40). The belief in constructivism is that knowledge is constructed out of personal sets of meanings, based on experiences encountered in pertinent environments (Newhouse, 2002:8). According to Kozma (2003:2), constructivism envisions a learning process in which students set their own goals, plan their learning activities, and monitor their current levels of mastery and understanding in preparation for lifelong learning. It moves concepts of school beyond the notion of a place where knowledge is imparted, to one of classrooms, organisations, and societies as knowledge-building communities (Scardamalia & Bereiter, (1994) cited in Kozma, 2003:2). Contrary to criticisms by some (conservative/traditional) educators, constructivism does not dismiss the active role of the teacher or the value of expert

knowledge (Martin-Stanley & Martin-Stanley, 2007:1). It modifies that role, so that teachers help students to construct knowledge rather than to reproduce a series of facts (Educational Broadcasting Corporation, n.d:1). This is why some such as Perkins (1999:6) argue that "Constructivism" is pragmatic and should be viewed as a toolbox for problems of learning, from which astute teachers should choose and use whatever works for them and their students. This is because, as Perkins (1999:6) continues to argue, although most constructivist classrooms feature active, social and creative learning, different kinds of knowledge (inert, ritual, conceptually difficult and foreign) invite varied constructivist responses, not one standard approach. From this argument, it is clear that constructivism advocates for such an approach where the learner becomes the central figure, but that the role of a capable and well-trained teacher will remain irreplaceable. The question is therefore: What will the new role of teachers in an ICT era be?

2.7.1.1 ICT will not replace the teacher's role

Currently instruction in most schools is too didactic and lacks personal contact between teachers and students and among students (Knapper, 2001:94). Oliver (2002:2) contends that conventional teaching has emphasised content with teaching activities geared to its mastery and recall, with little or no emphasis on skills acquisition. Modern settings, however, Oliver further argues, now favour curricula that promote competency and performance. In other words it is more concerned with how information is learnt and used rather than with the information itself (Oliver, 2002:2). In this context, the role of the teacher has to change in order to produce the kind of learner the 21st century education system (such as the Outcomes Based Education (OBE) (1994-2011), envisaged. According to the Department of Education (2003b), OBE in South Africa needed teachers to begin teaching in a variety of new ways that actively involved learners in their own learning. They needed to be linking school learning with the learners' critical thinking and problem-solving skills. This has necessitated a paradigm shift in the roles of the learner and teacher respectively. The learner has moved from being a passive recipient to being an active constructor of knowledge who must be guided through a process of self-discovery, with the teacher as facilitator of the process (Newby et al, 2000:7). This new role of teachers is well captured in the Rwandan Ministry of Education's ICT policy that "Teaching, using ICT, requires concerted efforts to shift teaching methods towards a more learner-centred and interactive methods, whereby the teacher takes

more of a facilitator role, moving away from the direct instructional 'Chalk-&-Talk' approach" (Rwanda Ministry of Education, 2008:2).

Therefore, teachers as agents of change need to change their perceived role in the classroom from that of presenters of knowledge to guides and facilitators, guiding learners to discover and create knowledge on their own (Forsyth, 1996:31). This approach of teaching involves engaging actively and collaboratively in "real world" problems and tasks (Wheeler, 2000:3). Yuen, Law and Wong (2003:167), in their research on ICT integration in different types of Chinese schools, quotes a learner who best summarises the role of teachers using ICT:

> "I think the teachers' role has changed. Their role is not to impose information on us. We should learn and search for information by ourselves. The role of the teacher should be teaching us how to live a meaningful life, help us improve our morale and spirituality … If we can explore, learn and think by ourselves and the teachers' role is to inspire, then we can understand the world and different issues better (Yuen, et al, 2003:167).

Consequently, much emphasis must be put on the need to assist teachers with relevant professional development and support in using computers for teaching and learning, thereby acknowledging the important role of the teacher as mediator. As Bialobrzeska & Cohen, (2005:7) argue, the teachers' role is never displaced by the use of a computer or any other form of information technology or software package. Thus the teacher's role in planning, facilitating and evaluating any lesson involving ICTs remains central (Bialobrzeska & Cohen, 2005:7).

In this context, it is clear that e-learning will not replace teachers but will only enhance the quality and reach of their teaching and greatly reduce the amount of time spent doing administrative duties (DOE, 2003). In the South African context, teachers cannot blame the interference from the Department of Education for their lack of change. This is because,

> "Although what to teach is prescribed for teachers, through the medium of a national curriculum (such as Outcome Based Education/OBE) or some mandatory document (such as the National Curriculum Statement/NCS), precisely how to teach it, how to organise the children and the classroom for teaching is something generally left to the teacher" (Pritchard, 2007:21).

Thus, Bialobrzeska and Cohen (2005:35) argue that if extreme caution is not taken by the teacher, learners can waste valuable time trying to find the information they need to learn and "copying meaningless facts instead of actively looking for and processing information from carefully selected resources to answer specific and purposefully set questions". Or, conversely, they can be kept busy for hours playing interactive games that do not give enough feedback on options selected (Bialobrzeska & Cohen 2005:35).

Newhouse continues to argue that the teacher needs to become a facilitator of cooperative learning by involving students in real problem solving and not perpetuate the old paradigm of teaching (Newhouse, 2002:25). Similarly, Moll, as cited by Prince (2007:18), defines the learning process in a constructivist paradigm as follows:

> "Learning is an active process involving the learners constructing meaning for them. The process requires the application of knowledge, skills and values. It is a problem-solving approach, which leads to new knowledge for the individual. The basis for the approach is discovery learning: new knowledge comes from reconstruction by discovery" (Prince, 2007:18).

The journey for reconstructing new knowledge through discovery needs proper guidance from well-trained teachers. This is why "Constructivism", does not entail that all learning must be by discovery or that the place of teachers and the curriculum be removed (Newhouse, 2002:9). DeCorte (1990:74*)* gives a perfect prospect of how constructivism and the old or traditional paradigm (a traditional paradigm is the one in which teachers were instructors who tell the students what they need to know) can be successfully married in schools. As he puts it:

> "A powerful computer learning environment is characterised by a good balance between discovery, learning and personal exploration on one hand, and systematic instruction and guidance on the other, always taking into account the individual differences in abilities, needs, and motivation between students" (DeCorte, 1990:74).

Similarly UNESCO researchers (as quoted by Bahati, 2010:11) argue that in a "conservative education system, ICTs may be used to support either teacher-centred or learner-centred pedagogical approaches or to use a combination of the two approaches". Such a balance between teacher-centred or learner-centred pedagogical approaches is perfectly shown in the following Table 4.

Table 4: Implications of different pedagogical approaches for different technologies

Teaching style	Main pedagogical characteristics and implications for the use of technology
Teacher-centred approach	The focus is on the teacher as the source of knowledge. The teacher tends to be active while the learner is expected to receive the knowledge being dispensed rather passively. The teacher talks, the learner listens. The teacher acts, the learner watches. This is convenient for large class sizes. A wide range of technologies can be used to aid the teacher's presentation and performance. Handouts, overhead projector (OHP) slides, models, etc, can all be used to capture and retain the learner's attention.
Learner-centred approach	The emphasis is on the learner as knowledge-seeker, with the teacher as facilitator and guide. The learner tends to be active, talking and doing things in the process of learning. The teacher designs and manages the setting as well as the process for learning. This is difficult with large class sizes.

Table 4 adapted from Bahati (2010:11) & UNESCO (2005)

From the foregoing it is quite evident that if computers (and other ICT resources) are to have a genuine impact on learning, the teacher has to continue with his mediation responsibility. Such a new role of teachers requires a paradigm shift in teachers' competencies.

2.7.1.2 Paradigm shift in teachers' competency

Kress (2000:133), cited in Lawrence & Veena (2013:1) argues that "the previous era had required an education for stability, but the coming era requires an education for instability". This is because the introduction of ICT in teaching and learning requires that teachers' competencies be reviewed or redefined. Such review and redefinition of teachers' competencies depends on the development of the whole life of man/woman and education (Kress, 2000:133). Wheeler (2000:4) argues that the paradigm shift in the teacher's role is necessitated by two key reasons. Firstly, introduction of ICT's will cause certain teaching resources to become obsolete. For example, the use of the chalkboard and overhead projector

may no longer be necessary if all learners have access to the same network resource on which the teacher is presenting information (Wheeler, 2000:4). It is also possible that teachers who fail to embrace technology will find it difficult to function effectively in an ICT age. This is because, as Lawrence and Veena (2013:1) argue, in order to be fully prepared to function productively in a technology-oriented society, students (learners) must develop not only fundamental computer skills but also proficiency in using a variety of technology tools to solve problems, make informed decisions and generate new knowledge. The development of these skills, as in other basic areas of knowledge, is the responsibility of the schools and their instructional staff (Lawrence & Veena, 2013:1). Yet many of our teachers and educators lack the necessary skills themselves to be comfortable in playing a leadership role in the integration of technology into classrooms. There is therefore an urgent need for improving teachers' ICT competency in order to prepare them to help learners. Gupta (cited in Lawrence & Veena, 2013:2) defines competencies as "knowledge, skills, attitudes, values, motivations and beliefs people need in order to be successful in a job". In this context, these competencies include ICT competencies. According to Lawrence and Veena (2013:2), ICT competencies are based on using tools and technical equipments for the reaching, and transferring of knowledge. They include any technology that helps to produce, manipulate, store, communicate and/or disseminate information. In short, the ICT competencies are a set of technology standards that define proficiency in using computer technology in the classroom. The ICT competencies are grouped into four general domains: (1) Basic Technology Operation, (2) Personal and Professional Use of Technology Tools, (3) Social, Ethical and Human Issues, and (4) Application of Technology in Instruction (Lawrence & Veena, 2013:2).

Furthermore, ICT's may make some assessment methods redundant (Wheeler, 2000:4). For example, currently most assessment is still based around the use of textbook technology and on a factual retention approach to learning (Newhouse, 2002:37). This kind of assessment is not suitable for the ICT environment and, as such, it is bound to change (Newhouse, 2002:37). In light of the argument presented here, it can be argued that in order to maximise the benefits of using ICT in teaching and learning, the Department of Basic Education and all teachers' training colleges/schools need to help teachers to acquire or increase not only their teaching competencies (subject and methodological competencies) but also their ICT competencies, in order to enable them to facilitate learning in an ICT era.

2.7.2 How will the paradigm shift in teachers' ICT competency be facilitated?

A good summary of the importance of ICT competency for teachers was well presented by Lawrence & Veena (2013:2). These two authors argue that teaching is a complex activity. According to them, competent teachers apply broad, deep and integrated sets of knowledge and skills as they plan for, implement and revise instruction (Lawrence & Veena 2013:2). However, in order for teachers to do their work effectively they need to have received proper and comprehensive training from their training institutions/colleges. This is what is known as 'the Pre-service training of teachers'.

2.7.2.1 Proper Pre-service training of teachers

According to Carlson and Gadio (as quoted in UNESCO, 2012:119), teacher professional development is absolutely essential if technology provided to schools is to be used effectively. According to Lawrence and Veena (2013), teachers' fundamental skills come first. Simply put, "spending scarce resources on informational technology hardware and software without financing teacher professional development as well is wasteful" (Lawrence and Veena, 2013:2).

It should always be borne in mind that teacher training is central to ICT integration. Training of teachers and managers (principals) will take place in the form of pre-service, in-service and continuous professional development opportunities on areas of ICT literacy, content development, pedagogical teaching approaches using ICT, Educational Management Information System (EMIS) capacity building and maintenance of ICT facilities to make sure they are available at all times to all users (Rwandan Ministry of Education, 2008:2).

Standards for ICT competency should be set firstly for pre-service teacher training (Flor, 2008:41). This is the domain of higher institutions of learning. According to van Rij & Warrington (2010:13) university training courses for new teachers urgently need to address the pedagogical dimension by including instruction in modern teaching methods, exploiting ICT hardware and software to provide a superior educational experience to students. This needs to be complemented with specialised courses for existing teachers in order to reach the entire teaching workforce.

Similarly Balanskat (2007:15) argues that "teachers entering the profession may have little formal training in using ICT in teaching in a significant number of countries", so training becomes paramount. He contends further that this may be due to a number of factors. These factors include inter alia:

> "lack of equipment or experienced trainers, training being unrelated to day-to-day practice, or the absence of ICT in the course. In addition the independence of teacher training institutions can also lead to uneven rates of effective integration of ICT across a system" (Balanskat, 2007:15).

In the Philippines, the Commission on Higher Education has revised policies and standards for undergraduate teacher education curriculum to provide for the inclusion of six units of education technology (ICT) (Flor, 2008:23). This endeavour seeks to capacitate teachers upon entry into the system and set standards for competency. This is an indication of how much the Phillipine Department of Education values teacher training in ICT. In South Africa, standards for professional competency in ICT utilisation will consider the following levels:

> • "Entry – computer literate, able to use computers and teach learners to use computers;
> • Adoption – able to use various technologies, including the computer, to support traditional management, administration, teaching and learning;
> • Adaptation – able to use technology to enrich the curriculum and to use integrated systems for management and administration;
> • Appropriation – able to integrate technology into teaching and learning activities and to use integrated systems for management and administration within a community context;
> • Innovation - prepared to develop entirely new learning environments that use technology as a flexible tool, so that learning becomes collaborative and interactive. Technology is integrated as a flexible tool for whole school development" (Department of Education, 2003).

Given the good example of the Philippines above, Ngololo, Howie and Plump (2012:13) recommend that the Namibian Ministry of Education: "establishes effective learning communities and involves the University of Namibia and other educational institutions to

develop teacher training programmes focusing on ICT implementation in science classrooms". In South Africa the ICT development strategy in schools has not involved universities at all in teachers' professional development (Howie et. al, 2005). This might have changed during the past 10 years. But, this omission has created a serious void in teachers' professional development in ICTs. However, in order to use ICT equipment effectively in their work, teachers need to be lifelong learners to keep themselves updated with the changes in technology and new teaching methods. Therefore, while the pre-service training of teachers focuses on equipping teachers with the necessary subjects knowledge and the pedagogy to teach them, other forms of training such as in-service training are necessary to keep the teachers ICT skills at an acceptable level and up to date.

2.7.2.2 Training teachers to become technology proficient

Technology proficiency (including technical skills and instructional applications) is but one dimension of teacher competence (Lawrence & Veena, 2013:2). Consequently, as they continue to argue, the acquisition of technology knowledge and skills must be connected with the development of a broader array of competencies. Teachers must be proficient in the subjects they teach in order to make meaningful impact. Technology cannot do the job of an incompetent teacher. Early attempts to develop technology standards for teachers were isolated from the broader teacher competencies and were focused primarily on technology skills. In countries such as the USA, the International Society for Technology in Education (ISTE) has actively addressed the technology isolation problem and has recently released a set of revised teacher technology standards. These standards were developed through a rigorous process of expert and lay-person input. The NETS-T Project (National Educational Technology Standards for Teachers) explicitly describes what competent teachers should know and should be able to do with technology in the context of broader teacher competencies. The NETS-T standards are categorised as follows: (1) technology operations and concepts, (2) planning and designing learning environments and experiences, (3) teaching, learning and the curriculum, (4) assessment and evaluation, (5) productivity and professional practice, (6) social, ethical, legal and human issues (see International Society for Technology in Education (ISTE) (The NETS-T, 2000:1).

2.7.2.3 Training in Basic ICT competencies for teachers

According to Galanouli, Murphy and Gardner (2004:65), “The importance of professional development for the successful uptake of ICT in the classroom attracts strong endorsement in the literature”. According to Lawrence and Veena (2013), other ICT-specific fundamental skills include basic actions such as: managing electronic files, using computerised databases and spreadsheets, sending and receiving e-mail messages, and creating documents with graphics. These skills are prerequisites for more advanced skills, such as accessing online resources, creating desktop publishing documents, developing multimedia presentations, selecting and customising instructional software to fit students' needs, streamlining record-keeping and other administrative procedures with electronic tools, and observing the correct protocols in sharing intellectual property. The competencies are organised into five aspects: productivity, communication, research, media and presentation (ISTE, 2000:1).

a) **Productivity**: According to Lawrence and Veena (2013), productivity may include composing standard educational publications such as parent newsletters and handouts for students and class lists, and teaching students how to prepare their own documents on a computer. Productivity also includes administrative work such as putting student test scores into a spreadsheet and analysing them, as well as preparing curriculum materials with digital tables and graphs of curriculum content. It also includes the ability to organise information graphically using specialised graphic organiser programs, as well as general tools such as word processors or presentation programs, to create digital representations of educational information (ISTE, 2000 cited in Lawrence & Veena, 2013:2).

b) **Research is also vital for teachers (and students alike):** In their professional preparation as well as in their classroom assignments, the teacher chooses the most appropriate research tools and databases, and applies the most effective search techniques, to produce useful and safe online resources in the classroom. Teachers and students also need the skills to locate the sources of information and, once located, the teacher should know the difference between authoritative and untrustworthy sources, how to ascertain authorship, and how to find sources with different points of view. The teacher should be able to teach these skills to students (ISTE, 2000, Lawrence & Veena, 2013:2-3).

c) **Communication:** One of the basic and important skills teachers should have is the ability to communicate using digital tools. Teachers' skills should include email, instant messaging, mobile colleagues, and knowing how to organise and manage these tools in the classroom. In addition, they should be able to collaborate online for learning in order to takes advantage of the tools such as blogs, wikis, chats, audio and videoconferencing, to bring outside resources into the classroom and to encourage academic collaboration among students (ISTE, 2000; Lawrence & Veena, 2013:2-3).

d) **Presentation:** Teachers should be able to create effective digital presentations using common tools for preparing slide shows, videos and podcasts. With these skills, the teacher can create presentations that follow the principles of communication, and can apply these design principles to the evaluation of students' digital work. Once created, the teacher should be able to deliver digital multimedia presentations to students. Using common devices such as computers, projectors and screens, the teacher can set up classroom presentations and arrange for students to do the same (ISTE, 2000; Lawrence & Veena, 2013:2-3).

e) **Media:** The competencies in terms of media require teachers to have the ability to:
(a) differentiate instruction with digital media (ISTE, 2000). This includes an awareness of assistive technologies for disabled students as well as the ability to use a computer to prepare and present academic ideas in a variety of forms for better learning by all students,
(b) capture and edit images, audio and video (Lawrence & Veena, 2013:2-3). The teacher can use digital still and video cameras, edit their output on a computer, and produce learning materials that range from simple slide shows to the archiving of student presentations and performances,
(c) produce digital multimedia educational experiences. With this competency, as Lawrence and Veena (2013:2-3) continue to argue, the teacher can combine media from a wide array of sources into a useful presentation of academic content, and can teach this skill to students,
(d) employ new media devices for learning. From large Smartboards to tiny iPods to science probes, the teacher can incorporate a variety of digital devices into the instruction in the classroom (ISTE, 2000).Those are the skills that just about every teacher needs, no matter the subject or grade. Beyond these are the more specific

> technical skills required of a high school math teacher or a teacher of visually-impaired students, competencies that would be embedded into specialised courses and programs (ISTE, 2000; Lawrence & Veena, 2013:2-3).

Other developed countries such as the United Kingdom (UK) also had specific national initiatives such as the New Opportunities Fund (NOF) training for all UK teachers. The NOF's strategic objective was that all teachers must become competent in using ICT in their teaching by 2003 (Galanouli, Murphy and Gardner, 2004:64). NOF training was in operation during the period 1998/9–2002/3 and was designed to raise the standard of pupils' achievements in UK schools by developing the ICT expertise of all 450 000 of the UK's serving teachers (Galanouli et al. 2004:64). The NOF's budget was about £230 million (ibid). According to Selwyn (2000), though this may seem a huge investment when set against the target of making all 450 000 of the UK's teachers confident and competent with ICT, it actually represents a mere £500 per teacher. This amount was provided by the UK National Lottery sources.

While there is an initiative to provide laptops to teachers in South Africa (as will be discussed below), and there is some ad hoc computer training for teachers by NGOs and private companies such as the Internet Service Providers' Association of SA (ISPA), such training is often too short (lasting between one and ten days) to equip teachers with sufficient ICT skills they need to become proficient in using ICT to perform activities such as research, preparing and planning their lessons and delivering such lessons in the manner that benefits students. It can therefore be argued that the provision of computers (laptops) at schools is not enough without the presence of qualified professionals equipped with the necessary skills to teach learners to use them (Kasonde, 2007:1). Thus, even though some teachers have undergone basic ICT training, they need to have adequate and up-to-date equipment, because technology requires continuous upgrading and education (The New Times, 2013:1). Teachers also need to be regularly retrained in order to keep up with ICT development. This objective could be achieved through "in-service training".

2.7.2.4 In-service and continuous development and training for teachers

Training of teachers who are already in the employ of the education departments is of cardinal importance with regard to ICT implementation. Firstly, Balanskat (2007:15) remarks that the content of training developed by training institutions may fail to match needs and

lacks the pedagogical and practical dimension. In-service training can help to improve this situation, when teachers get additional training opportunities to sharpen their existing knowledge. According to Meyer (1999:171), no matter how effective employees are, there are times when they will be confronted by some aspects of their work that they have not experienced before. When training is given at the workplace by a manager, a supervisor or co-workers or an expert hired by the company for that purpose, it is called on-the-job training (OTJ) or in-service training.

Teachers need in-service training for ICT because technology keeps changing and teachers need to keep themselves up-to-date with new technology. Balanskat (2007:15) argues that countries are already investing heavily in developing the ICT skills of serving teachers. This is highly commendable. However, he argues that interventions and support for teachers are not always system-wide and/or effective. Balanskat blames lack of in-service training for teachers as one of the problems teachers are currently facing. In his own words, "there appears to be little classroom-based in-service training, little encouragement of communities of practice, few online opportunities or specific measures aimed at school leaders" (Balanskat, 2007:15). The in-service training of teachers cannot be reduced to a two-day or three-day workshop (Newhouse, 2002:45). Teachers require a continuous provision of professional development to maintain the appropriate skills and knowledge needed for ICT integration (Balanskat, 2007:45). McFarlane, as cited by Prince (2007: 21) emphasises that teachers who are uncomfortable with computers, and who fail to see how they can be used to enhance learning, simply do not use them. One-day awareness courses are clearly inadequate to address this huge skill gap, yet this is the most commonly experienced form of in-service training (Prince, 2007:21).

Beyers (2000:52) argues that teacher training does not mean throwing resources at it. A more comprehensive strategic intervention for teacher training in ICT integration needs to be developed and adopted by those involved, if it is to be effective (Beyers, 2000:52). "Research suggests that teachers adapt more easily to new technologies through a step-by-step approach with minimal disruption, and that on-site is preferable to off-site training" (Balanskat, 2007:37). The in-service training approach is said to have had a positive effect on teachers in countries such as Brunei and Greece.

In Brunei Darussalam, for example, in-service courses are run from time to time by the University Brunei Darussalam and the Ministry of Education (Khalid & Salleh, 2010: 41). This ensures that teachers are kept abreast with new developments in ICT utilisation. In Greece, through the Odysseia project, a significant group of teachers participated in computer training in order to be able to present: "in-service training and act as trainers for the rest of the teachers in their school in accordance with the specific needs of each school" (Giavrimis, Giossi & Papastamatis, 2011:284). It is also critical to continuously monitor the computer training programs offered to ensure that they fulfil the desired effect. Research findings on why teachers participate in a training program in ICT conducted in Greece (Giavrimis et. al 2011:287) has revealed some startling revelations.

> "The most important reason (why they participate) is to enable themselves to take advantage of ICT in their course preparation and teaching, while a reason of minor importance is the contribution of a program certificate to the salary development of a teacher. A total of 20 to 25% of teachers give other reasons for their participation in these programs: the enrichment of their curriculum vitae, the opportunity to temporarily change their working environment" (Giavrimis et al, 2011:287).

The fact that about 20 to 25% of teachers give other reasons other than being able to take advantage of ICT in their course preparation (and the teaching of students in particular) is serious cause for concern. If teachers who have made significant investments to learning these skills and demonstrating them were certificated, it would boost impact (Balakanski, 2007: 41).

2.7.2.4.1 Issues of quality of the in-service and continuous development programmes for teachers

Continuous development and training for teachers should be comprehensive to cover all the skills and knowledge teachers need. That is, computer training should involve much more than the development of computer literacy skills (Newhouse, 2002:45; Hogdson, 2012). It also needs to develop skills in teachers for integrating computer use into their teaching/learning programmes (Newhouse, 2002:45). Teachers need to be able to design and adapt content materials to suit the needs of their own students as well as to search and manage information (Farrell & Isaacs, 2009a). Equally, Cox, Preston and Cox (1999), after having researched teacher training in ICT's, discovered that, even after having attended

professional development courses in ICT, some teachers still did not know how to use ICT in their classrooms; instead they just knew how to run a computer and set up a printer. This could be attributed to the failure of the program to focus on training teachers how to develop the pedagogical aspects of ICT and only concentrating on the acquisition of basic ICT skills (Bingimlas, 2009:240). Although the road to ICT mastery by teachers through training is mired with shortcomings, it is not all doom and gloom. Some teachers feel that training has empowered them to use technology, making their jobs much easier (Miller, Naidoo & Van Belle, 2006: 9). It is important for teachers to have time available to improve their ICT skills (Bingimlas, 2009:242). This time should be provided for in the timetable and teachers need to make their own personal time to maximise their knowledge of ICTs. Self-training is also vital to increase proficiency and improve ICT use (Bingimlas, 2009:242). Self-training is probably the best option because it is based on the will and passion of teachers to capacitate themselves.

Furthermore, the role of partnerships between governments and non-governmental organisations in ICT training for teachers cannot be overemphasised. For example, Mikre (2011:9) argues that:

> "With the help of the World Links program, many countries are now using ICTs as ways of providing teachers with new skills and introducing innovative pedagogies in the classroom. For example, teachers in Chile acquired familiarity with computers for professional (such as student marks, parent reports) and out-of-classroom tasks (e.g. searching for educational content on the web and lesson-planning activities). The program also provides 200 hours of teacher training that include an introduction to ICT, use of the Internet for teaching and learning, use of tele-collaborative learning projects, integration of ICTs into the curriculum and teaching, and innovative pedagogical approaches" (Mikre 2011:9).

In South Africa, private organisations such as SchoolNet SA provide online, mentor-based in-service training to teachers to introduce ICT into the curriculum and for management (DOE, 2004). In addition, the INTEL Teach to the Future teacher development programme provides teacher training in ICT integration into teaching and learning (DOE, 2004). The INTEL Teach to the Future program is also operational in the Philippines (Flor, 2008:23) where it performs the same function as in South Africa. The success of these programmes provides an area for further investigation and is beyond this research.

2.8 Paradigm shift in learners' role and ICT competencies

According to Wheeler (2000:3), the use of ICT will change the role of the learner, enabling children to exert more choice over how they approach their study and requiring less direction from teachers. ICTs by their very nature are tools that promote, maintain and sustain independent learning (Oliver, 2002:3). However, as mentioned previously in this chapter, learners will continue to need guidance and assessment by skilled teachers (Riel, 2000:5; Martin-Stanley & Martin-Stanley, 2007:1). Contemporary learning theories, such as constructivism discussed previously in this chapter, postulate that: "Learning is an active process of constructing knowledge rather than acquiring knowledge through the memorisation of facts" (Oliver, 2002:4). Similarly, Pritchard (2007:6) asserts that learning is a building activity in which individuals build an understanding of events, concepts and processes, based on their personal experiences and often supported and developed by, amongst other things, activity and interaction with others; these activities can be enhanced with the aid of ICT (Martin-Stanley & Martin-Stanley, 2007:1). In summary, the change in learning approaches has necessitated a paradigm shift in the roles of the learner and teacher respectively; the learner has moved from being a passive recipient to being an active constructor of knowledge who must be guided through a process of self-discovery with the teacher as facilitator of the process (Newby et al, 2000:7). Therefore, in order to facilitate efficiency and effectiveness of ICT in learning, teachers must not neglect learners' IT skills because these affect the integration of ICT (Rumpagaporn & Darmawan, 2007:1). Correspondingly Bahati (2010:18) argues that the work of lecturers, no matter how competent they are, will not effectively facilitate integration if the student's IT-skills are ignored. Students like teachers, need to be adequately equipped with sufficient and proper ICT tools and skills to benefit from the use of ICT in teaching and learning. According to ISTE Standards for students "Simply being able to use technology is no longer enough. Today's students need to be able to use technology to analyse, learn and explore". Imparting sufficient ICT skills to students is very important because, not only does this help students to succeed in school, but "Digital age skills are vital for preparing students to work, live and contribute to the social and civic fabric of their communities" (ISTE. National Educational Technology Standards for students, nd:1).

However, while this seems possible in developed countries (such as the USA and UK), it is almost impossible to equip learners in rural areas with the necessary ICT skills for them to

function effectively. For example, most learners/students in rural areas have no computer knowledge or ability at all. This is because most schools in rural areas have no computers. The few schools that do have some computers have no access to the Internet because of the costs or lack of money to keep these computers in working condition. There is also a dire shortage of competent teachers to teach ICT skills, especially in rural areas. This problem is compounded by the fact that few people in rural areas of South Africa have access to computers at home. A simple survey which asked students (Grade 10, 11 and 12) how many of them (100) had access to a computer at home or through a friend at a school in the outskirts of Durban, South Africa, found that 96 of them had never touched a computer. This is not surprising given the fact that, according to a recent national survey in 2012, there are 14 450 161 households in South Africa but only 3 092 542 of these have a computer at home. The rest, about eleven million households in South Africa, have no access to computers. The problem is even worse in mostly rural provinces such as the Eastern Cape and Limpopo where, according to the report provided by South African Statistics in 2012, except for the Eastern Cape (11,9% in 2011); Limpopo Province (with about 12%) has the lowest percentage of households owning a computer (StatsSA, 2012a). That is, 88% (i.e. 1 242 949) of a total of 1 418 102 households neither own nor have access to computers in Limpopo Province (StatsSA, 2012a:16). Given the high level of illiteracy and the rural status of this province, it can be safely argued that most people in Limpopo Province have no technical skills to operate computers, let alone for their children to use them to access study materials (StatsSA, 2012a). Therefore, while ICT is likely to change the role of learners in developed countries and some areas of South Africa (such as urban areas) that can afford ICT equipment and the necessary infrastructure (as well as the finances to keep ICT in good working order) and have qualified teachers to use ICT to teach learners, it is not clear how ICT will change the role of learners in rural areas where these facilities do not exist at schools or at the learners' homes. Furthermore, if teachers do not have sufficient ICT skills, it is not clear how they will be able to use ICT to teach their subjects or help the students/learners to benefit from initiatives such as the Teacher Laptop Initiative (TLI) which was initiated by the South African Government in 2009. These challenges require the South African Government to invest heavily and comprehensively in teacher training in general and ICT training for teachers in particular. There is also a need for investing in ICT equipment and infrastructures (such as electricity) and establishing proper funding mechanisms to cover the costs of running the ICT equipment (for example, Internet connectivity, maintenance of ICT equipment) in schools. Without skilled teachers and students, and access to properly

maintained ICT equipment, it is not clear how ICT will benefit teachers and learners in resource-strapped countries and rural areas of South Africa in particular.

2.8.1 The future of textbooks in the ICT era

Given the many benefits provided by computers and the Internet as discussed in the previous sections, there is always a temptation to overemphasise their importance at the expense of textbooks. From the researcher's own observation and direct interaction with learners doing science expositions in 2010 at Magulasavi High School, when the Internet and computers were overemphasised, learners tended to simply take excerpts of information from the Internet and paste them into their answer books, then present these as their own research, without acknowledging or adapting their sources. This practice ultimately robs these learners of the opportunity to master essential research and writing skills. Gultig (2001:182), in arguing for the use of textbooks to supplement the Internet, contends that textbooks, unlike computers, are arranged systematically, logically and are structured in a developmental way which allows learners to develop and progress systematically. He argues that textbooks also afford teachers an opportunity to track learners' development and progress.

The problem is, therefore, according to van Rij and Warrington (2010:8) that textbook publishing houses have generally failed to embrace ICT and develop teaching material with simulations, games etc. related to IT. However, new technology is emerging to counteract the continued neglect and discarding of textbooks. In South Africa a new 'cutting edge' digital manual has been designed by Maramedia Publishing (Mohlala, 2012:6). This new device offers a combination of textbooks, study guides and workbooks to support and also extend beyond the Curriculum Assessment Policy Statements (or CAPS) (Mohlala, 2012:6). Van Niekerk of Maramedia Publishing (as quoted by Mohlala, 2012:6) articulates that textbooks could be replaced by advanced interactive digital manuals within the next ten years. According to St Clair of Google South Africa, (also quoted in Mohlala, 2012:6), the interactive digital manuals are engaging and flexible and link the digital world to textbooks. With this new development in the publishing industries, as Mohlala (2012:6) puts it: "The days of pupils buckling under the weight of carrying their schoolbags stuffed with heavy textbooks will be a thing of the past". The eBook technology has the added advantage of allowing students to study in their mother tongue (Grossmann, 2008:2). For example, in Cambodia, a new ICT textbook in the Khmer language was launched in 2008 for use by all schools, universities and teacher training facilities that have computers (HanRith, Sotharith &

Vanchhon, 2010:49). Similarly, in Indonesia the eBook programme was established in 2007 with the primary objective of providing students with quality but inexpensive textbooks at very low prices (Wahyudi, Tamimuddin & Nurhidayat, 2010:68). The main objective of developing these e-Book technologies is to try to ensure computers do not take learners away from the real world but, rather, enhance their perceptions of it (Chan, 2003; Low, 2003). One teacher quoted in Adams (1985:35) remarked that the computer should never be used as a substitute for interacting directly with the environment. Children should paint with real paint brushes, dance real dances, and collect real flowers rather than just doing these things on a computer screen (Grossmann, 2008:2). However, given the huge backlog and problems with textbook delivery that South Africa has had recently, the development of such an eBook could bring much relief to already strained resources. The researcher could not find any records of a similar e-Book for any of the eleven different languages in South Africa.

2.9 CHALLENGES FACING INTEGRATION OF ICT IN SECONDARY SCHOOLS

Integration of ICT entails the combination of all parts of the technology to enhance learning, including hardware and software, together with each subject-related area of curriculum (Shelly et al., 2008:327). In addition, integration can be described as using technology to help achieve the outcomes of each lesson, unit or activity. According to Edutopia (n.d.), technology integration is the use of technology resources – computers, mobile devices such as smartphones and tablets, digital cameras, social media platforms and networks, software applications, the Internet, etc. in daily classroom practices, and in the management of a school. According to Edutopia (n.d.), successful technology integration is achieved when the use of technology is:

- Routine and transparent
- Accessible and readily available for the task at hand
- Supportive of the curricular goals, and a help to students to effectively reach their goals.

According to the ISTE National Educational Technology Standards for Students (n.d.:1):

> "Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. That is, technology

should become an integral part of how the classroom functions and be as accessible as all other classroom tools".

Integration is necessary because technology in itself does not support learning. Its full potential can only be realised when it is entirely and astutely integrated into the learning environment by the teacher her/himself (Summak & Samancioglu, 2011:1). Therefore, teachers are central to ICT integration in the classroom. In South Africa, integration of ICT provides a means for expanding access to quality secondary education in less privileged and remote communities (Evoh, 2007:14). Becta (2004:127) argues that teachers can successfully integrate the use of the web into their teaching by:

- "Drawing on the skills and qualities associated with good teaching in general, such as setting high expectations, intervening purposefully, involving all pupils and creating a stimulating classroom climate
- Using ICT to genuinely enhance teaching and learning
- Using a range of different ICT applications (ICTs) for teaching a range of topics
- Embedding ICT into their schemes of work, using and adapting national frameworks to suit individual needs
- Using ICT to manage teaching, learning and assessment of the subject
- Building on and extending the whole school approach to ICT to create or adapt highly imaginative resources".

Based on this analysis, a pertinent question arises with regard to the integration of computers: What are some of the salient challenges facing their integration into teaching and learning?

2.9.1 Some common obstacles to successful ICT integration in schools and their proposed solutions

According to Bingimlas (2009:235) the act of integrating ICT into teaching and learning is a complex process and one that may encounter a number of difficulties. Therefore, due to ICT's importance in society and possibly on the future of education, identifying these possible obstacles to the integration of technologies in schools would be an important step in improving the quality of teaching and learning (Bingimlas, 2009:235).

The successful integration of new technologies into education varies from curriculum to curriculum, place to place, and class to class, depending on the way it is applied (Becta, 2004; Buabeng-Andoh, 2012). The fact that challenges facing schools with regard to the implementation of ICTs are idiosyncratic to specific settings means that they (i.e. these challenges) are not the same for every school and teacher (Yuen et. al, 2003:168). In addition, it is the entire education system that needs an overhaul and not technology-specific challenges, in some instances. Hence Kobus Roux, manager at the Corporate Social Investment Responsibility (CSIR) at Meraka Institute (cited in Mtshali, 2012:2) posits that technology that is introduced into a broken system is a waste of time until the education system is fixed. Fixing the education system before introducing ICT is vital because, if not, the new technology introduced is not going to yield the desired results in a broken/dysfunctional education system. In light of these complexities, literature tends to highlight amongst others, the following as being the common obstacles to successful ICT integration: lack of teacher confidence, lack of teacher competence, lack of effective training, resistance to change and negative attitudes, lack of technical support and lack of infrastructure (Korte & Hüsing, 2007; Becta, 2004). These challenges facing integration of ICT in secondary schools are summarised in Figure 1 and each one of these challenges is briefly discussed below.

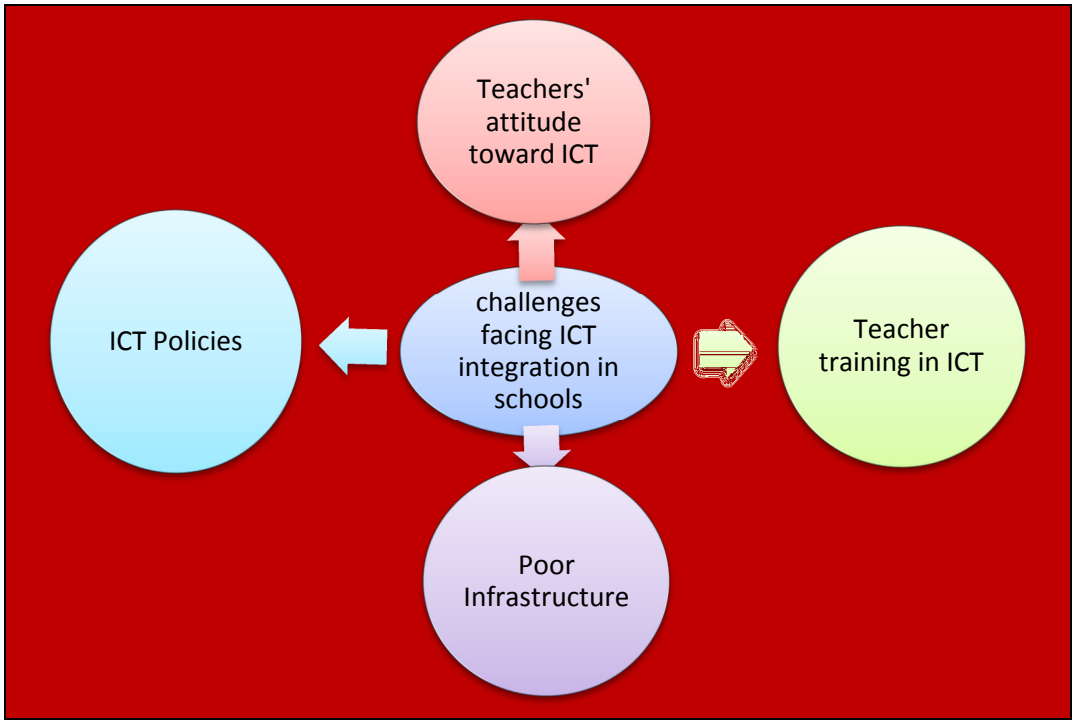

Figure 1: Factors that affect the integration of ICT
Sources: Adapted from Korte & Husing, 2007; Becta, 2004

2.9.1.1 Teacher training in ICT

Naturally the use of ICT in teaching, learning and managing educational institutions, just like any other innovation, compels the emergence of a new set of skills, attitudes and pedagogical approaches that requires continuous training programs to build sufficient capacity among teachers, developers, educators and administrators (Rwanda Ministry of Education, 2008). This means that, while most schools are now equipped with computers, Internet access and occasionally more sophisticated equipment such as interactive whiteboards and effective e-Learning requires far more than the mere introduction of hardware in the classroom (van Rij & Warrington, 2010:8). Similarly, Bialobrzeska & Cohen (2005:7) argue that it is not sufficient to have a room full of computers in a school. For them (the computers) to mean anything, teachers must be conversant in utilising them to implement an integrated approach in ICT use and new approaches (Bialobrzeska & Cohen, 2005:99). Gomes (as quoted by Bingimlas, 2009:239) concluded from his research that lack of training in digital literacy, and lack of pedagogic and didactic training were the major obstacles to using new technologies in classroom practice. In addition, Beyers (2000:52) argues that in view of the current scenario characterised by lack of capacity, there is a heightened need to fast-track the training of teachers. The Department of Education (DoE) in South Africa appears to have the right aims for training programs, but primary data suggests that these aims are not being realised (Miller, Naidoo & Van Belle, 2006:11).

2.9.1.2 Teacher support

There is no doubt that teachers need support in making use of new technologies to enhance their personal work before learning to use them in their teaching (Lankshear & Snyder, 2000:121). But, as Mikre (2011:14) puts it, "For the effectiveness of ICT integration, administrators must be competent and have a broad understanding of the technical, curricular, administrative, financial and social dimensions of ICT use in education". In addition, teachers need to continually work at updating their own skills and knowledge in the operation and use of ICT (Newhouse, 2002:38). Until there is support in practical ways by principals and department officials and for teachers, as well as a change in teacher attitude (Newhouse, 2002:38), acquisition of the new sets of skills relevant to ICT use and knowledge shall remain elusive. More importantly, it is the quality of leadership that determines teachers' attitude to a great degree (Oladosu, 2012). For example, principals in good and outstanding schools

provide noticeable support for their staff to integrate ICT effectively into their teaching, "often modelling good practice through their own teaching and through their use of ICT in large-scale events and communications with parents" (Ofsted, 2011:19). Literature shows that schools which exhibited less effective leadership and management with regard to ICT integration displayed the following common characteristics:

- "There was a lack of awareness of, or urgency in dealing with, current weaknesses.
- The school had no shared plan for the contribution of ICT to raising standards.
- Only occasional staff training was available, with limited goals.
- Few review processes were used to highlight areas for attention, with a tendency to be overgenerous in self-assessment.
- School development planning focused on tasks, rather than on improving outcomes.
- There was little or no planning for future investment or renewal" (Ofsted, 2011:32).

According to Beyers (2000:52), it is assumed that educators are currently well qualified to teach in the classrooms of today, but there is a need for them to be better equipped to cope with the demands of educating learners to face the challenges of tomorrow's digital world. Teacher training on the use and role of ICT in learning has not been satisfactorily addressed, and utilisation of ICT has by and large been left up to the instigation of individual teachers (van Rij & Warrington, 2010:8). There are diverse reasons why this situation exists. In his study on how primary teachers use computers in their daily lives, Haaparanta (as quoted by Keijo 2011:40), discovered that teachers do not have enough knowledge about using technology in instruction in a pedagogically grounded manner, thus capacity building and ICT literacy are essential. It follows that the training and regular upgrading of teachers in these skills are therefore of crucial importance for the integration of technology into daily educational practice (Howie, Muller & Paterson, 2005:xv). This is because, as Bingimlas (2009:240) argues, if teacher training is ineffective, teachers may not be able to access ICT resources even if they are provided. This is consistent with the South African Department of Basic Education's assertion that the deployment of ICT does not guarantee its efficient utilisation: capacity building and effective support must accompany it (DoE, 2003).

Some of the South African Government initiatives to deal with ICT training for teachers were shown at the opening of the Vodacom Information and Communication Technology (ICT) Centre in Vhembe, Limpopo. Ayemoba (2013) posits that the centre is one of nine centres

being established in each of the provinces as part of the Vodacom Mobile Education Programme. This type of ICT education centre for teachers is the realisation of a partnership formed between Vodacom and the Department of Education in order to help boost teacher training across all nine provinces of South Africa (Ayemoba, 2013). The centre makes educational material available through cloud computing. It is the intention of the programme to train about 1 400 teachers annually in the use of ICT to support teaching and learning, focusing in mathematics and science subjects.

Additionally a number of teachers from rural areas of South Africa are continuing to benefit from the "Train the Trainer" Project which has been initiated by the Internet Service Providers` Association of SA (ISPA) since 2001. ISPA is a non-profit South African Internet industry body that recognised the growing need for computer skills training in previously disadvantaged communities and established the "Train the Teachers" Project in December 2001. Through this initiative, ISPA says it has assisted educators in developing their personal computer and organisational skills, knowledge and abilities. The initiative is said to have already provided ICT skills training to more than 2 000 teachers across South Africa. A large part of the initiative targets schools in under-resourced and rural areas and is set to deliver beginner and intermediate level courses. According to Fiona Wallace, the chairperson of the ISPA Teacher Training Working Group: "The courses aim to equip teachers with practical computer skills. This will enable them to use technology to produce learning materials, subject plans, assessments and marks records, as well as to complete administrative tasks more efficiently" (ISPA, 2011:1). Although the above represents only a fraction of the entire teacher population, it provides a valuable contribution to the development of teachers with regard to ICT in South Africa. There is, however, a concern that these initiatives focus on beginners and intermediate computer skills without equipping teachers with the necessary skills to benefit fully from ICT usage. There is a need for training initiatives to equip teachers with the ICT skills they need to be able to use in schools. Such skills should include evaluation of material found on websites: "How to make educationally appropriate use of resources for learning Accessed: in this way, including how to develop visual literacy skills, adapt material, design differentiated activities using the same resources and develop material" (Bialobrzeska & Cohen, 2005:111).

2.9.1.3 Teachers' attitude toward ICT

According to Wheeler (2000:3), teachers have been polarised in their acceptance of new technologies. This is because, whilst some have passionately integrated computers, others have guardedly welcomed it whilst others have simply rejected the technologies. It appears that beginner teachers and expert teachers respond differently to ICTs (Wheeler, 2000:3). With regard to ICT implementation, school staff and teachers appear now to be more agreeable to the prospect of ICT in education (Farrell & Isaacs, 2009:28a), although in some instances there is basic resistance to change by many teachers (Shelly et al, 2008:328). The resistance in the acceptance of ICT in the classroom is primarily based on the "risk of teachers losing influence over the values and directions of classroom activity" (ibid). Therefore the potential of computers disturbs some teachers who are concerned about their own role and influence in the classroom (Chan, 2003:36; Low, 2003). Resistance to change is not a barrier in itself but an indication of a presence of a much deeper problem (Bingimlas, 2009:238) which must be investigated and dealt with by curriculum planners, principals, teachers and all stakeholders in education. It is highly improbable that teachers can simply resist technology without a reason. This deeper problem as espoused by Cox et al (1999a) appears to be the lack of the necessary education in accepting the changes and the absence of sufficient long-term opportunities to make sense of the new technologies for themselves.

It is the researcher's conviction that teachers need to develop a positive attitude towards ICT in order to benefit from it. This is correspondingly consistent with Mikre (2011:12) and Oladosu (2012)'s assertion that teachers' attitudes play an important role in the teaching-learning process that utilises computers and Internet connections (Mikre, 2011:12). The human factor determines the success of any ICT integration solution or any other solution that is implemented in education (Beyers, 2000:52). From the foregoing it becomes quite evident that computer implementation or integration will require changes, not only in classroom practices and development of new skills by teachers, but also in teacher attitudes (Newhouse, 2002:38). It cannot be overemphasised that teachers' perceptions are crucial to the success or failure of integrating ICT into instruction, and play a vital role in this process (Can & Cagiltay, 2006). Positive attitudes of teachers are accentuated by a number of factors. Amongst these are a supportive, enthusiastic and visionary leadership (Becta, 2004; Buabeng-Andoh, 2012). The assertion is equally supported by Yuen et al (2003:168) who argue that "The leadership role of individual schools plays an important part in shaping the responses to ICT innovation".

Teacher attitude is also shaped by lack of confidence resulting from lack of motivation to utilise ICT. Motivation comes from having the required IT skills (Mikre, 2011:12). When training in ICT utilisation is provided, the majority of teachers and school principals report that trained teachers gain positive attitudes about technology and about teaching (Mikre, 2001: 9). In addition, although some teachers may have positive attitudes to technology, they simply refrain from using it in teaching because of low self-efficacy (Mikre, 2011:12). In the White Paper on Education in South Africa it is declared that the Department of Education, in motivating teachers and schools, "will continue with its incentive programme for the most improved schools award in the category Technology Enhanced Learning Award. This incentive is aimed at awarding excellence in the creative use of ICT and to inspire learners and teachers to exploit the full potential of technology" (DOE, 2003). The incentives are directly awarded to schools. In the Phillipines conversely, the incentives are directly targeted at the teacher as the central figure in ICT integration and not at schools (Flor, 2008:24). Incentives are for outstanding teachers who have demonstrated best practices in using ICT in teaching and learning in the form of Innovative Teachers Leadership Awards. These incentives include a PC unit and participation in team-building courses (Flor, 2008:24). This is more appealing and motivating to teachers as it directly benefits them. When teachers are made aware of the potential benefits of ICT, they drastically change their attitude towards it (Newhouse, 2002:12). They need to be persuaded that their teaching might be made more effective and their pupils' learning enhanced by ICT (Sonekh & Davis, 1997:141).

2.9.1.4 Poor infrastructure and lack of policy

Apart from teachers' lack of capacity and attitude toward ICT usage, poor infrastructure remains a major obstacle in many developing states (Howie et al, 2005). According to Makewa, et al, (2013:54), a survey in the USA by the National Centre for Education Statistics (NCES) in 2000 using the Fast Response Survey System (FRSS) revealed that 99% of full-time regular public school teachers had access to computers or the Internet somewhere in their schools. This is still a dream in many developing countries such as South Africa. Nonetheless, many countries (including developing countries such as South Africa) have increased the number of computers in schools in recent years or have plans (such as the Teacher Laptop Initiative in South Africa and Kenya) to increase teachers' and learners' access to computers (Kargiban & Siraj, 2009:1447). Infrastructure cannot be limited to

connectivity, electricity, telephone lines and computers; it also includes appropriate hardware, useful software and adequate access to computer systems (Newhouse, 2002:39). In instances where software exists, it has often been chosen and purchased based on price and securing a larger number of workstations without focusing on quality (Newhouse, 2002:41). This compromises the quality uptake of ICT. Schools therefore need to procure software based on quality and efficacy. This involves the evaluation of software to ensure that it is well designed. Evaluation similarly demands a certain level of expertise in education and computer use in the person who will ensure that the software is appropriate for the educational setting (Newhouse, 2002:40). The issue of appropriate software for schools is often left to ICT experts such as school ICT technicians, without consulting the teachers.

2.10 ICT infrastructural challenges in South Africa

According to the DoE (2003), disparities reflected in South African society also find expression in ICT integration into education. The Department of Education recognises that it is difficult to compile an ICT profile for South African schools. This is because statistics are influenced by various factors, including the rapid redundancy rate, the level of usage and the sharing of ICT resources. However, according to the Department of Education survey of school needs, only 8% of schools reported having two or more computers in 1996. Only 38% of schools had grid electricity and exchange line telephones which are the basis of Internet (DoE, 1996). In addition, based on data from the Education Management Information System (EMIS) Department of Education, Pretoria and information received from provinces (listed in Table 5), the number of schools with computers for teaching and learning has increased from 12.3% in 1999 to 26.5% in 2002. However, despite the fact that the situation seems to have improved to some extent by 2002, there are still more than 19 000 schools without computers for teaching and learning. The table displays the number of computers each province has and how many of those are used for teaching and learning purposes.

Table 5: Provinces and computers in schools (2002)

Provinces	Schools with computers	Schools with computers for teaching and learning
Eastern Cape	8.8%	4.5%
Gauteng	88.5%	45.4%
Kwazulu Natal	16.6%	10.4%
Mpumalanga	22.9%	12.4%
Northern Cape	76.3%	43.3%

Limpopo	13.3%	4.9%
North West	30.5%	22.9%
Western Cape	82.4%	56.8%
National average	**39.2%**	**26.5%**

Adapted from the Draft White Paper on E- education, 2003

The table above indicates that although schools had computers in all provinces in 2002, these were mainly used for tasks other than teaching and learning. In addition, the table highlights the lack of computers for ICT integration in the Eastern Cape, Kwazulu Natal and Limpopo. Government is, however, geared to support curriculum implementation through the use of ICT (Department of Education Annual Report 2009/10). In supporting curriculum implementation through the use of ICT, government will invest in national initiatives to increase access to ICT, boost the capacity of managers, teachers and learners and provide electronic resources of the highest quality (Department Of Education,2003) Central to equipping schools with ICT infra-structure is the provision of electricity and physical infrastructure. This is because, the combination of computers and the Internet, mobile devices and "The Cloud", has transformed human experience, empowering individuals through access to knowledge and markets, changing the relationship between citizens and those in authority, and allowing new communities to emerge in virtual worlds that span the globe (NDP, 2011:83). However, the NDP (2011:83) also emphasises that: "the continued and equitable expansion of information and communication technology (ICT) depends on electricity". Thus, the real divide over the next 20 years will be between those who have access to reliable electricity to power these devices and those who do not (ibid). Government acknowledges that, although there are ICT provisions that use alternative sources of energy, the Department of Education will work with the Department of Minerals and Energy to prioritise the electrification programme for General Education and Training (GET) and Further Education and Training (FET) (Department Of Education:2003).

2.10.1 Roll out of ICT infrastructure and connectivity in South Africa: Teacher Laptop Initiative (TLI)

Accessibility of new technologies for teachers is widespread and differs from country to country (Bingimlas, 2009:240). However, some African countries are making considerable efforts to increase access to ICT for teachers. For example, according to Oladosu (2012:46), in an attempt to equip schools with computer hardware and software, the Nigerian Federal government ordered one million laptop computers for 24 million public primary schools and also launched "Schoolnet Nigeria" to create learning communities for educators and learners

(see also Agyeman, 2007). Similarly, according to Belio Kipsang, Kenya's education principal secretary, in an effort to enhance the success of the E-learning programme, the Kenyan government: "has trained thousands (about 150 000 trained with more than 300 000 to be trained in the near future) of teachers in preparation for the introduction of E-learning in primary schools as scheduled for the first quarter of the 2013/2014 year" (see Belio Kipsang, cited by Murule, 2013:1). In the same way, on 1 July 2009, Naledi Pandor, the former Minister of Basic Education in South Africa (2004-2009) unveiled government's Teacher Laptop Initiative (TLI) strategy. Managed by the Education Labour Relations Council (ELRC), the initiative aims at improving Information and Communications Technology (ICT) in teaching and learning and aims to ensure that more than 350 000 government school teachers own and use a laptop, by providing them with a monthly allowance which will cover the purchase costs as well as the costs of connectivity (ELRC Annual Report, 2010/11:80). The Teacher Laptop Initiative (TLI) was designed to address a need for a quality education system and forms part of a plan by the Department of Education and other stakeholders to improve the overall quality of education in South Africa. According to the Education Labour Relations Council (ELRC)'s report (2010:9), the launch had a key focus on training and development, particularly ICT, computer literacy and pedagogy as well as brief demonstrations on connectivity (e-mail and internet) to illustrate the different ways that ICT can be incorporated in the classroom (ELRC, 2010:9).

The ICT packages for teachers consist of a laptop with prescribed minimum specifications, including software for school administration, the National Curriculum Statement (NCS) documents, as well as Internet connectivity, insurance and finance, as per the requirements of Government Gazette 32207 of 2009 (DOE, 2009:6). Contents to be loaded on the teachers' laptops include: School administration package of SA-SAMS, National Curriculum Materials, National Curriculum Statements, Learning Programme Guidelines, Subject Assessment Guidelines, Qualifications and Assessment Policy Documents, Exemplars, Matric Exam Papers, Teacher Training Manuals and Teacher Guidelines (DoE, 2009:6). The laptops themselves must have a 160G hard drive, wireless LAN, Ethernet LAN and voice-fax modem Internet connectivity and a Windows XP, or higher, operating system (Africa, 2009:1).

According to Bauer (2011:1), teachers qualifying for the laptop were to receive a taxable monthly allowance of R130 for five years and personally fund the rest of the package, which was predicted to cost between R250 and R390 a month over five years. The teachers would

then take ownership of the laptop once repayments were settled (DoBE, 2009:12). Teachers across the country have generally welcomed the launch of the Teacher Laptop Initiative (TLI), saying they were looking forward to sharing ideas, learning from each other and improving the quality of the education system (Khumalo, 2010:1). The initiative was also hailed by Thobile Ntola, the president of the South African Democratic Teachers' Union (SADTU), saying that the technology will allow the department to circulate information directly to the teachers (Khumalo, 2010:1). The TLI was welcomed by professional organisations such as the National Professional Teachers' Organisation (NAPTO) whose President, Ezra Ramasehla, said "The laptops will make a difference in helping teachers to deliver quality service in the classrooms". However, in just under two years after the announcement (official launch) of this TLI initiative (i.e. in 2011), the South African media were carrying stories that "The teacher laptop initiative (TLI) has collapsed" (Bauer, 2011:1).

According to the ELRC's Annual Report 2010/2011 presented to Parliament on 13 October 2011, the anticipated rollout and implementation of the initiative was hindered by the following:

- Lack of proper funding: Government had to review the funding model for the provisioning of the laptops for teachers as a significant number of educators are unable to qualify for finance in terms of the National Credit Act; because of the rules of profiling in terms of the Act. For example, in September 2011, as Bauer (2011:1) continues to argue, the *New Age* reported that the R500-million that was budgeted for the project by the department for the 2009/2010 financial year was spent on teachers' salaries. The fact that the DoE had to use the TLI for salaries suggests lack of proper planning and possibly lack of proper inter-departmental coordination between the DoE and the Treasury.
- The problem of lack of planning and funding on the part of the Basic Education Department was compounded by the fact that these laptops were to be given on credit which means teachers who were blacklisted or who were not creditworthy would not qualify for the necessary finances. According to Govender, the Accounting Officer of the ELRC, banks and finance houses were specifically reluctant to fund these and other teachers if there were no state guarantees (ELRC, 2011:80). According to Maluleka (2011:1), about 174 000 teachers of about 380 000 who are permanently employed nationally, are either blacklisted or not credit worthy.

In addition to these two problems, the principle of deducting money directly from teachers' salaries also had the potential of putting some financially struggling teachers under additional financial pressure. It is not clear why the Minister of Basic Education did not negotiate with SARS to make the laptops tax-deductable. The teachers did not get any allowance for the upkeep and running of the laptops. Furthermore, while personal access to a computer for teachers for the purpose of preparation and planning is one of the strongest influences on the success of ICT training and subsequent classroom use, there was no guarantee that those who received laptops used them for teaching and learning activities, or that they had the necessary competency to use them (Office for Standards in Education, 2002:3). The TLI was supposed to have completed the distribution of laptops to all qualifying teachers by the end of 2011 (Tubbs, 2013:1), but because of funding problems and the black-listing of some of the TLI beneficiaries, this objective has still not been achieved by 2013 (ibid). The TLI management has now been moved from the ELRC and been put under the DoBE in a bid to try to move it forward (Tubbs, 2013:1). It is not clear when this project will be completed. The Department of Basic Education needs to find strategies to deal with the costs of the laptops and their upkeep, ensuring that teachers have Internet connectivity, and needs to provide support and teacher training in order for the TLI to have an impact on the teaching and learning, especially in rural areas of South Africa.

2.11 Some reasons why ICT rollout initiatives in education fail

There are many reasons why ICT rollout fails. According to Mthobeli Tengimfene, head of CSI Projects at the Vodacom Foundation, cited in Mtshali (2012:9), the rollout of ICT cannot be blamed on a single problem. In South Africa, for example, Tengifene argues that a number of factors are likely to contribute to the failure of ICT policies, such as the following.

2.11.1 Lack of policy and policy on ICT implementation

In terms of policies, according to Mtshali (2012:9) and Chowdhury & Khatun (2013), a number of countries like South Africa, Namibia, Bangladesh and Uganda have developed ICT policies for their countries. However, despite the availability of these policies, governments have struggled to implement them and to achieve their policy targets. In South Africa, government rhetoric by politicians such as the Minister of Basic Education and

government policies such as the Teacher Laptop Initiative (TLI) Policy of 2009 suggests that government is willing to embark on the transformation of education through ICT (DoBE, 2009). In terms of this policy, the TLI (started in 2009) was supposed to have been completed by 2011. By 2013 the project has still not got off the ground. In fact, some argue that there is no clear implementation strategy or plan for the department's ICT policy in South Africa (Mtshali, 2012:9).

The weakness in the South African ICT policy is first of all associated with financing challenges, namely lack of or insufficient funding. At one point, the Department of Basic Education had no money to implement e-Learning (implementation of the TLI) because the budget for the initiative had been used to pay teachers' salaries (see Maluleka 2011:1). This is a clear indication that the department of Basic Education did not have a dedicated budget to ensure successful ICT penetration and integration (Mtshali, 2012:9). The ICT policy was, for example, criticised for failing to clarify how private Internet service providers would be reimbursed for the Internet connectivity services which are necessary for teachers to access teaching material but are not funded by government. According to the South African Institute for Distance Education (SAIDE) (2005:7), without proper policies and careful planning and consideration of what can realistically be sustained financially and in terms of infrastructure and human resource capacity, there is no chance of successfully integrating the use of ICTs into schooling in South Africa. A discussion of some of the legislative frameworks and policies developed by South Africa with regard to ICT use follows hereunder.

2.11.1.1 ICT Legislative framework and policies in South Africa

There is a plethora of legislation that provides an enabling environment to access to ICT in South Africa. According to the South African Information Technology Industry Strategy SAITIS (2002:14), the term "legislation" refers to "a formal signal of intent on the part of government to embark on a specific course of action". SAITIS (2002:14) further argues that:

> "Legislation creates predictability and certainty, conditions that are often crucial in influencing the private sector (especially foreign investors) whether and where to invest. If appropriately framed, legislation can also enhance the transparency of government action and promote accountability by designating responsibility and providing the instruments whereby performance may be measured".

The purpose of these legislations and policies is to enable all South Africans (irrespective of where they live in the country) to use ICTs in order to improve the quality of their lives in particular and the South African economy in general. The researcher has attempted, for lack of space, to include in this analysis only those legislations that have direct relevance to ICT in education. It should, however, be noted that the legislation discussed here cannot be considered an exhaustive list. Looking at the ICT sector, ICT legislation can, therefore, make a significant contribution towards enabling the desired outcomes of other policies, especially the Education Policy and the South African Constitution (1996). A discussion of some selected legislations follows hereunder.

2.11.1.2 The South African Constitution of 1996

Section 32(1) of the Constitution of the Republic of South Africa affirms the fundamental right of access to records and/or information held by the state or any other person that is required to exercise one's rights. Among the children's basic rights protected by Section 29 of Chapter 2: Bill of Rights in the South African Constitution is that "everyone [including the children] has the right to both basic and further education … which the state, through reasonable measures, must make progressively available and accessible" (Section 29 (1) and (2) of the South African Constitution, 1996). A number of Acts have been enacted by the South African government in order to put into practice the principles of the South African Constitution. Among them are the Promotion of Access to Information Act (PAIA 2000, the

Telecommunication Act, 103 of 1996, the South African Information Technology Act, the SAITIS and the Education Labour Relations Act (ELRA).

2.11.1.3 The Promotion of Access to Information Act (PAIA)

The Promotion of Access to Information Act 2000 (here under referred to as PAIA) is critical to the access and use of ICT in schools because, when people have access to Information Communication Technologies, they are able to access information held by the state and send information speedily (Republic of South Africa: Labour Relations Act, 2000). PAIA describes the nature of the records kept by government departments and distinguishes between those records that are automatically available to the public and those that need to be accessed: through processes set out in the PAIA. However, while PAIA articulates that information sought should be received "inexpensively yet swiftly", it is quite difficult or practically impossible for people (in this case the learners and their teachers) to access such information. The desire to meet the requirements of the Constitution and PAIA to provide inexpensive and swift access to information irrespective of where people stay in South Africa resulted in the introduction of the Telecommunications Act, 103 of 1996.

2.11.1.4 The Telecommunications Act 103 of 1996

Section 9 of the South African Bill of Rights articulates that everyone is equal (Republic of South Africa, 1996:7). This equality also extends to universal and equal access to communication services and infrastructure to all persons irrespective of socio-economic status and geographic location in South Africa. The South African Government acknowledged and recognised the fact that affordability of ICT services is a critical factor in the promotion of universal and equal access to ICT services in South Africa (Department of Communications, 2013:7). In its endeavour to promote and support on a national scale availability of communications infrastructure, services and facilities to particularly inaccessible and impoverished communities, the South African government introduced the Telecommunications Act, 103 of 1996 (hereunder referred to as the Telecommunications Act). In terms of easing access to ICT in education, Section 45 of the Telecommunications Act stipulates that:

> "From a date to be determined by the minister, all public schools as defined in the South African Schools Act, 1996 (Act No. 84 of 1996) and all public further education and training institutions as defined in the Further Education and Training

> Act, no. 98 of 1998), shall be entitled to a 50% discount on all telecommunication calls to an Internet service provider; and any connection or similar fees or charges levied by an Internet service provider for accessing the Internet or transmitting and receiving any signals via the Internet or for such access and transmission and reception" (see also Howie, Muller, & Paterson, 2005:11).

It is therefore government policy that schools must have access to Internet-linked computing facilities for educator and learner use. The intention of the South African Government is that, where feasible, computer facilities must be used outside school hours by the school and the wider community, with cost recovery, as appropriate. Specifically in education, the DoE portal Thusong is expected to provide "access to a host of curriculum and support material" to the teachers and learners (DoBE, n.d.:1). In order to achieve this objective, a fund known as "the Universal Service Fund" has been established by the South African Government in the Department of Communication. Section 66(1)(c) of the Telecommunications Act (1996) provides that money from the Universal Service Fund shall be utilised exclusively by public schools and public Further Education and Training institutions for the procurement of Internet services and equipment necessary to access Internet.

However, as discussed in various sections of this research (especially in section 2.12.3 Lack of funding for Internet connection), this discount (also referred to as e-Rate Policy) has not been properly implemented and, therefore, the costs of Internet access and ICT usage in general is still an obstacle to e-Teaching and e-Learning in most South African schools, especially those in rural areas. In fact, in many instances school authorities do not even know of the existence of such discount provision in the Telecommunications Act so as to hold the Department of Communications to account. To date, some schools do not even have telecommunication lines. It is also not clear whether the 50% discount envisioned in the Telecommunications Act and the "organisational funding framework" would not leave some schools underfunded, considering that, according to the South African Schools Act, Act 84 of 1996, some schools will receive lower grants than others. The organisational funding framework for all schools in South Africa is based firstly on the poverty level of the community where the school is located and, secondly, on the number of learners at the school. This means that a school with a large number of learners in a particular area will have more funding than another school in the same area which has fewer learners – yet both will need to spend the same amount of time to download the learning materials. Therefore, despite

the presence of legislation in South Africa, government has in its own admission failed to "make it simpler and cheaper for South Africans to have access and use Information Communications Technologies in their homes, communities and workplace and most importantly at schools where e-learning is supposed to take place" (Department of Communications, 2013:7).

2.11.1.5 Critics on fragmentation of ICT policies and implementation

According to SAITIS (2002:14), South Africa does not have a comprehensive ICT policy. The legislative provisions are scattered throughout the government departments (SAITIS, 2002:30) and are specific to the sector they have been developed for. Hence we have different acts that deal with access and use of ICT in the education sector whose implementation success is heavily dependent on other policies based in other departments such as the Department of Communication, the Department of Labour (for example, Skills levies for teachers' ICT training etc.). There is a view that the absence of such a comprehensive policy is not the result of a lack of political will but is "the result of the speed with which developments occurs in the sector and the complexity of the issues involved" (SAITIS, 2002:5). Nevertheless, this situation has the potential to create "potential conflict and detract government from pursuing a universal approach" to ICT integration in South Africa (SAITIS, 2002). This is also the view held by Pule, the former Minister of Communications. According to Pule, "The fragmented approach adopted … does not maximise efficiencies and in future will increasingly hamper the capacity of the sector to fulfil socio-economic development". Her argument was that the silo (i.e. fragmented) approach to the sector needs to be reviewed so that the South African Government does not inadvertently create a digital divide where access to quality communications services, technologies, infrastructure and content is a privilege of the elite, rather than a right for all (Department of Communications, 2013:10). Such weaknesses are also acknowledged in the National Development Plan (National Planning Commission (NPC), 2011). With regard to ICT legislative and policy framework, the National Development Plan states that, in the short term, government should conduct a full policy review (Department of Communications, 2013:7). This is an honest admission by government that the current policy and regulatory framework has failed to meet the objective as set out in the National Development Plan. This review process is expected to culminate in the development of a "new integrated policy" (Department of Communications, 2013:11). Ngcaba (2012:8) contends that the development of such a new policy paradigm "is aimed at ensuring that South Africa repositions itself as a leader in the ICT sector on the continent,

serving as an example of visionary and enabling policy development and implementation". The outcomes of this review could not be analysed because they were not available at the time of writing of this research.

Although the NDP proposed an integrated ICT legislative and policy framework, the provision of ICT remains the responsibility of the Department of Communications, and various government departments are still directly responsible for operationalising their own policies. Therefore, the negative impact of such a fragmented approach in ICT legislation and policy implementation remains a challenge and a barrier to the use of ICT in improving teaching and learning. The Skills Development Amendment Act, No. 31 of 2003 seeks to develop the skills of the South African workforce (including high school teachers); to increase the levels of investment in education and training in the labour market. To achieve this, government initiated levies on all employers (including government which employs most teachers in public schools) to set aside funds to accomplish this objective by creating opportunities to acquire new skills. However, the implementation of the Skills Development Amendment Act in the teaching sector falls within the ambit of the Department of Labour – not the Department of Basic Education which employs them. Sadly many teachers to date remain untrained due to financial constraints. According to the Employment of Educators Act, 76 of 1998 which is the domain of the Education Department, if the employer is of the view that an educator, whether on probation or a permanent staff member, is not performing in accordance with the job that the educator has been employed to do, the employer must first ascertain if it has provided the necessary infrastructure and training necessary for the educator to perform at an appropriate level as envisaged by the department. It is then that the department can initiate a counselling and a charge of poor performance against the educator (Electronics Communications Act, 1995).

As an employer, it is the responsibility of the Department of Education to provide the necessary infrastructure and training for teachers in ICT as in all curriculum-related matters. However, some of the funds provided for training are not controlled by the Department of Education, but by the Department of Labour. Such fragmentation could explain why the Department of Basic Education has so far lagged behind in terms of ICT skills training for teachers. Often those that have been trained are inadequately trained to effectively use ICT. The other problem is the problem of overlapping and duplication when different departments are responsible for the provision of the same service to the employees (SAITIS, 2002:19).

Following is a summary of selected legislations having a direct or indirect bearing on access to ICT and teachers' ICT training in the South African education.

Table 6: Selected legislations having a direct or indirect bearing on access to ICT and teachers' ICT training in the South African education

Legislation	Description of the Legislation
The South African Constitution of 1996	This Constitution seeks to promote access to education as the basic right to the children and access to the information and the infrastructure for learning purposes as the responsibility of the state.
Promotion of Access to Information Act 2 of 2000 (PAIA)	PAIA seeks: • To give effect to the constitutional right of access to any information; • To set out justifiable limitations on the right of access to information aimed at protecting people's privacy, confidential commercial information and ensuring effective, efficient and good governance; • To balance the right of access to information with all the other rights in the constitution; • To promote a culture of human rights and social justice; • To establish mechanisms and procedures to enable persons to obtain access to records as swiftly, inexpensively and effortlessly as is reasonably possible; • To promote transparency, accountability and effective governance; It is also the responsibility of the Department of Education to ensure that the South African Education system "keeps up to date with developments in education systems internationally" (Department of Education, 2006:3).
National Education Policy Act, Act No. 27 of 1996 (NEPA), as amended	NEPA provides the basic framework for the National Minister to, amongst others, determine national educational policies for the planning, provision, financing, staffing, co-ordination, management, governance, programmes, monitoring monitor the implementation of these policies and evaluate the general well-being of the educational system (Section 4, subsections (1) to (3), National Education Policy Act, 1996). It is therefore the responsibility of the Department of Education to plan, implement and the necessary human and financial resources for the implementation of ICT in education. A good example is the TLI (Teachers' Laptop Initiative discussed in various sections of this research.
South African Schools Act, No. 84 of 1996 (SASA), as amended	The South African Schools Act (SASA) (1996) promotes access, quality and democratic governance in the schooling system. SASA broadly encompasses the development of an organisational funding and governance framework for all schools in South Africa. It ensures that all learners (irrespective of colour, gender etc. and areas where they live in South Africa) have the right of access to quality education without discrimination (Moabelo & Uwizeyimana, 2013), and makes schooling compulsory for children aged 7 to 14. It provides for, among other things, the school funding norms, prioritise redress and target poverty with regard to the allocation of funds for the public school system (Department of Education, 2006:4). In terms of SASA funding norms, learners from poor background who attend schools that are located in high poverty areas (mostly in rural and urban slums) are allocated more funds than those schools in affluent areas (mostly urban areas). In order to protect the Constitutional rights of the Children, most of

	schools located in high poverty areas, where parents and guardians are not able to afford the school fees, are now progressively becoming "no-fee paying schools" (Moabelo & Uwizeyimana, 2013).
Telecommunications Act, 103 of 1996.	This seeks to make new provision for the regulation of telecommunication activities other than broadcasting, and for the control of the radio frequency spectrum; and for that purpose to establish an independent South African telecommunications Regulatory Authority and a Universal Service Agency; to repeal the Radio Act, 1952, and the Radio Amendment Acts of 1957, 1962, 1963, 1969 and 1974 and to amend the General Law Amendments Acts of 1957 and 1975, the Post Office Service Act, 1974, the Broadcasting Act, 1976, the Legal Succession to the South African Transport Services Act, 1989, and the Independent Broadcasting Authority Act, 1993. This Act also provides for 50% discount to all public schools as defined in the South African Schools Act, 1996 (Act No. 84 of 1996) and all public further education and training institutions as defined in the Further Education and Training Act, no. 98 of 1998), on all telecommunication calls to an Internet service provider; and any connection as discussed in the previous sections.
Skills Development Amendment Act, No 31 of 2003	The Act seeks to develop the skills of the South African workforce ; to increase the levels of investment in education and training in the labour market and to improve the return of that investment; to encourage employers i) To use the workplace as an active learning environment; ii) To provide employees with the opportunities to acquire new skills; iii) To provide opportunities for new entrants to the labour market to gain experience, and iv) To employ persons who find it difficult to get employed. To encourage workers to participate in learnership and other training opportunities; ensure the quality of education and training in and for the workplace; to improve the employment prospects of persons previously disadvantaged by unfair discrimination and to redress those disadvantaged through training and education. As discussed above, the problem is that the skills levies levied in terms of this Act are administered by the Department of Labour while the Department of Education is responsible for providing training to the educators.
Electronic Communications Act No. 36 of 2005	Promote the convergence in the broadcasting signal distribution and telecommunications sectors and to provide the legal framework for convergence of these sectors; to make new provision for the regulation of electronic communications services, electronic communications network services and broadcasting services; to provide for the granting of new licences and new social obligations; to provide for the continued existence of the Universal Agency and the Universal Service Fund (RSA, 2005).
Electronic Communications and Transactions Act. No 25 of 2002	The act seeks to provide for the facilitation and regulation of electronic communications and transactions; to provide for the development of a national strategy for the Republic; to promote universal access to electronic transactions by SMME's; to provide for human resource development in electronic transactions; to prevent abuse of information systems; to encourage the use of e- government services.
State Information Technology Agency	This provides for the establishment of a company that will provide information technology, information systems and related services to, or on

Act No. 88 of 1998	behalf of, participating departments and in regard to these services, act as an agent of the South African Government
Employment of Educators Act, 76 of 1998	This provides for the employment of educators by the State, for the regulation of the conditions of service, discipline, retirement and discharge of educators and for matters connected therewith.

Adapted from Ngcaba (2012:23)

2.11.2 Lack of proper funding for ICT infrastructure

Lack of funding is one of the biggest huddles to ICT rollout initiatives in schools of developing countries. Apart from issues of funding ICT physical infrastructures (provision of laptops, computers/desktops, and other infrastructure such as electricity, telephone lines), the cost of internet and the structure of charges are equally important (Cairncross & Poysti, 2003:4). In addition to the need for money to buy laptops and other ICT equipment for schools, there is also a need for infrastructure such as electricity. The high cost of electricity in South Africa poses a serious barrier to ICT partnerships (Evoh, 2007:17). As argued by Evoh, the availability of electricity or lack of it in many parts of South Africa becomes the determining factor when schools and communities are chosen for ICT partnership initiatives. This makes the deployment of ICTs to these communities practically impossible (Evoh, 2007:17). To this end, other sources of energy (such as solar energy for longer term solution, generators as short term solution etc.) should be investigated and pursued. Given the limited resources of government, the Department of Basic Education should consider Public Private Partnerships (PPPs) to try to deal with the issue of lack of ICT equipment and the physical infrastructure of ICT in schools, especially in rural areas.

2.11.2.1 Public private partnerships (PPP)

There is a growing recognition that much of the backlog in the rollout of ICT infrastructure and development can be speeded up through Public Private Partnerships (Evoh, 2007:13). Governments across the world cannot cope on their own with the demand of ICT provision. PPPs may be the useful route for countries facing poor ICT infrastructure to explore (Pandor, 2007). The financing of ICT integration in schools by the private sector is based on the assumption that an information literate workforce will stimulate the demand for ICT products and services (Flor, 2008:40). This PPP is a sensible answer to the budget constraints that face public education (Flor, 2008:13). The Minister of Basic Education in South Africa, Angie Motshekga (2011), has implored private ICT companies to partner with government to

investigate and ensure the effective and efficient provision and use of ICTs to support teaching and learning. Some companies, such as International Business Machines (IBM), have partnered with the Department of Education as it continues to roll out the programme (DoBE, 2012:56). According to the IBM reporter, IBM has donated more than 1 000 Young Explorer units to disadvantaged communities in five provinces of South Africa (IBM, 2012:1). It also plans to ensure that more than 2 500 early childhood education practitioners will receive training in teaching and learning with Information Communications Technology and that the programme will reach more than 125 000 children (IBM, 2012:23). However, besides big businesses, government can also turn to Non-Governmental Organisations (NGOs) and foreign embassies, especially for funding schools in rural areas where big businesses might not be available or interested (Amedzo, 2007:22).

The Mindset Network Organisation and the Khanya Education Technology Project are some other examples of ICT in secondary education partnerships (Evoh, 2007: 15). The Mindset Network Organisation is a non-governmental organisation which makes use of studio broadcasting of secondary school curricula to teach many students in different secondary schools across the country at the same time. In order to receive the programmes, each participating school needs a digital satellite television (DSTV) decoder and a television set. The objective of the organisation is to use ICTs to expand access to and improve the quality of secondary education in South Africa (Evoh, 2007).

The Khanya Education Technology Project is another initiative of the Western Cape Education Department (WCED) in South Africa. The purpose of the project is to use information, communication and audio-visual technology to improve teaching and learning, or curriculum delivery in the Western Cape Province (WCED, 2004). The project seeks to deliver high quality learning resources through the medium of ICT. Some organisational members of the Khanya Education Technology Project collaborative partnerships are donors, while others provide products and services to Khanya at discounted prices (WCED, 2004).

Evoh (2007:17) argues that “private sector partners should address infrastructural challenges facing ICT in education diffusion in South Africa such as lack of electricity, by using alternative and sustainable sources of energy, particularly in rural areas without a conventional electricity grid” It is, however, very important to note that, in order to implement ICT policies, there must be political will. There appears to be an apparent inflexibility in the national and Departments of Education. Although the private sector is

willing to partner government to roll out ICT in South Africa (Evoh, 2007:16), the bureaucratic, rigid procedures of government often cause delays in reaching agreements, thereby further frustrating the efforts of the private sector. Instead, government should be providing an environment conducive for the private sector participation in mainstreaming ICT in secondary education.

2.11.2.2 Lack of funding for Internet connection

Cairncross & Poysti (2003:4) argue that students are prevented from using Internet as a research tool because Internet service providers' charges are based on time usage. This is not a problem that is confined to students only. Teachers too find it unaffordable to surf the Internet to access resources that support them. Cairncross and Poysti (2003:4) made a comparative analysis of the cost of Internet usage by different countries:

> "In Ethiopia the cost of 30 hours of Internet use in 2001 is US$109.57 (which is 12.49% of gross domestic product (GDP) per head, the highest ratio in the world), in Maldives US$244.69 (3.85%), in Argentina US$132.19 (0.21%) and in Germany US$24.13 (0.01%)" (Cairncross & Poysti, 2003:4).

There are no available statistics of the cost of Internet usage in South Africa. But, according to Wild (2013:1), Telecom experts have cited two major reasons for the low Internet penetration in the country: telecom provider Telkom puts ADSL connections beyond the financial reach of most South Africans, and mobile data providers' punitive ad hoc data costs mean that the poor cannot afford to use data on their phones.

From the foregoing, although a small sample, it can be argued that other countries are far ahead of many African countries regarding the provision of cheap Internet access for schools. Without reasonably affordable internet access, it is inconceivable that ICT can play a meaningful role in education (Cairncross & Poysti, 2003:4). Solutions to connectivity include governments providing cheap Internet access to educational institutions to fast-track ICT integration. This can be done through the promulgation of legislation that promotes an e-ate that offers discounted Internet access for schools, also known as e-rate (Farrell & Isaacs, 2009:19b).

Started in the USA, “e-rate” is at its simplest a nationally agreed upon discounted rate for Internet access for schools: often this rate is included in the relevant telecoms legislation at a national level and therefore the responsibility of the regulator (Espitia and School Net Africa, 2013:1). In terms of its strategic objective to achieve universal access to broadband in SA by 2030, the South African Government introduced major amendments to the Electronic Communications Amendment Bill in 2011, for example, it includes “e-rate” which it wants to introduce to stimulate and facilitate Internet usage by public schools. According to Section 3, Chapter 3 of the South African Schools Act, (No. 84 of 1996), “A public school may be an ordinary public school or a public school for learners with special education needs” (see also Mathevula, 2013:9). If implemented, the e-rate would allow public schools a 50% discount on calls to access the Internet as well as Internet access charges (Espitia and School Net Africa, 2013:1). Although this provision has been made in the Act, implementation of a national scheme has been slow and would need further major amendments before it is implemented. This is the view held by Wilson (2012:1) in his argument that “Schools e-rate needs more work”. According to Wilson (2012:1), the policy is flawed, “not least because there is no mechanism for Internet service providers to recover discounts from upstream network providers like Telkom”. He quotes, Dominic Cull, regulatory advisor at the Internet Service Providers’ Association (ISPA), who criticises the current structure of the e-rate, for putting the entire burden of the discount resulting in e-rates for schools to service providers, thereby making them run their business at a loss. According to Cull (cited in Wilson (2012:1), “It’s actually a disincentive to ISPs to service educational institutions because they can only provide services at a loss”. Cull, argues that, from a business point of view, the e-rate is well intentioned, but it doesn’t work in practice, because it goes against the business practices of making profit (Cull cited in Wilson 2012:2). He adds that while the Electronic Communications Act makes it clear that there should be a mechanism to recover costs from upstream providers, the Independent Communications Authority of SA (ICASA) has so far failed to create a suitable regulatory framework to deal with this issue (Cull cited in Wilson 2012:2). In fact, according to Wilson (2012:2), while ICASA has previously indicated that the e-rate provisions need revision, the issue does not even feature in its policy framework for coming years. Consequently, according to Miller et al (2006:12) the e-rate, envisaged in the South African ICT policy, does not appear to be making any considerable difference in the cost of Internet usage for schools in the few provinces that have embraced e-learning, such as the Western Cape. There is no doubt that lack of proper policy on e-rate is having a negative impact on ICT usage in the few schools that have embraced ICT in South Africa. For

example, according to Farrell & Isaacs (2009:19a), because of prohibitive Internet costs in South Africa, of the estimated 6 000 schools that have access to PCs, only an estimated 2 500 have Internet access. Unfortunately, this problem is not limited to one province or area of South Africa. The weaknesses in the Electronic Communications Amendment Bill have caused major implementation challenges in all provinces of South Africa (Farrell, Isaacs & Trucano, 2007:19).

Unfortunately, while South Africa is lagging behind, other African countries seem to be making major progress in implementing e-rates for schools. For example, according to Farrell & Isaacs (2009:19b), in Lesotho, the Ministry of Education has negotiated, at least in principle, Internet access to schools at reduced rates. In Senegal, Sonatel makes discounted Internet access available to schools, and, in Namibia an agreement between SchoolNet Namibia and Telecom Namibia provides 24/7 flat rate access to all schools (Farrell & Isaacs, 2009:19a). The Bangladesh government reports in its ICT policy that "the bandwidth capacity and availability will be ensured all over the country at a reasonable cost to encourage the growth of the Internet" (Republic of Bangladesh, 2003:2; also cited in Chowdhury & Khatun, 2013:2). Besides lack of policy and funding, ICT projects fail due to lack of plans for their sustainability.

2.11.2.3 Lack of plans for sustainability of ICT projects

Finally, there is lack of sustainability of ICT projects. Sustainability of ICT partnerships and infrastructure pose a problem for secondary education powered by ICT (Evoh, 2007:17). Evoh argues that many ICT-based education projects in South Africa lack elements that will enable them to survive beyond the rollout or demonstration phase. Similarly, the Department of Basic Education bears testimony to this assertion. The department concedes that it is no use having state-of-the-art technology unless it can be sustained beyond the implementation phase (Department of Education, 2003). Deployment of ICT in disadvantaged communities and schools requires more than ICT equipment donations or the funding of specialised programmes of the school; there is a need to pay added attention to the centre's sustainability (Akinsola, Herselman & Jacobs, 2005:33). Schools have to develop budgets that will see the projects beyond the implementation phase. Another aspect relating to sustainability is the physical security of the computers. Theft of equipment in schools is an on-going reality (Bialobrzeska & Cohen, 2005:89). Therefore the Department of Basic Education (and some

schools that can afford to have the resources) need to develop budgets to cater for this important facet. In South Africa where crime is highly rampant, the security of computers becomes paramount. Schools need to ensure that there is adequate security prior to purchasing any equipment (Bialobrzeska & Cohen, 2005:89). Bialobrzeska and Cohen (2005:89) further argue that most schools have resorted to burglarproofing and alarm systems as the main theft deterrent. In some areas, the appointment of local men as security guards, albeit unarmed, in addition to burglarproofing has prevented burglaries.. These men command the respect of the villagers. Although defenceless against highly sophisticated criminals who see schools as soft targets, they offer much needed security against the theft of very scarce ICT resources. Another vital element of the sustainability of ICT programme in South Africa is the broadcasting of teaching through radio and TV.

2.11.2.3.1 Broadcasting teaching through radio and TV

The second way to deal with the issues of high costs of teaching and learning through ICT would be to broadcast teaching, especially of difficult-to-teach topics, by expert teachers through radio, television and video (Peters, 2003:14). The cost of using this technology is relatively cheap compared to other tele-learning technologies (Moonen, 1997:1; Kruger, 2010:8). Tele-learning (also called distance learning or tele-education) is defined as making connections among people and resources via communication technologies, for learning-related purposes (Moonen, 1997:2). Research such as that conducted by Farrell & Isaacs in 2009 shows that radio and television broadcast programmes linked directly to formal schooling are the most common methods of teaching and learning used in underdeveloped and developing countries (Farrell & Isaacs, 2009a:18). Their research into countries such as Guinea, Togo, Djibouti, Tanzania and South Africa reveals that these countries use radio, television and print media more often than other technologies to provide supplementary curriculum content for teachers, and mathematics and science content, amongst other subjects, for learners (Farrell & Isaacs, 2009:18a). A typical example of this in South Africa is the Digital Satellite Television (DSTV) broadcast of the Learning Channel which primarily targets the final grade of the Basic Education band (i.e. Grade 12) (Isaacs, 2007:11). In South Africa, according to Isaacs (2007:20), the Open Learning Systems Education Trust (OLSET) also design, produce and broadcast interactive radio instruction programmes through the South African Broadcasting Corporation (SABC), a public broadcaster, effectively offering

all teachers easy access to much needed daily classroom support, regardless of distance and geographical location.

In most instances these programmes are broadcast during school hours and in the afternoons, to coincide with learners' lesson times at school and their supposed rest period at home respectively. Some of the broadly educative and informative programmes broadcast by the SABC include "Takalani Sesame" (an educational programme for children, a local adaptation of the UK renowned "Sesame Street" and Open University S2 (Davidson, 2006:25).

2.11.3 Conclusion

The plethora of literature on ICT points to the fact that the introduction of ICT and use in schools is an inevitable reality (Summak & Samancioglu, 2011; Isaacs, 2007; Goyal, Purohit & Bhaga, 2011). This process of integration, however, may be hampered by many factors. These factors include, inter alia, infrastructure, lack of capacity, and reluctance on the part of teachers to relinquish the old paradigm of teaching and negative attitudes towards ICT. In many areas, ICT equipment and information systems might be available but remain unused, due to lack of capacity and other infrastructures such as electricity. In this context it follows that government and government partners should provide regulated, coordinated and purposeful training programmes for teachers as a matter of urgency, but also must attend to the issue of infrastructures, especially in rural areas. The costs of e-learning and adequate policies of e-learning are other issues that need immediate government attention. The following chapter deals with research methodologies and research design.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The previous chapter presented a literature review by indicating what is available on the topic, of the use of ICT in education in the existing literature and identified gaps in the literature. This chapter describes the research design that was followed in this study. This description is followed by an outline of the rationale of the research. The study area is mapped out followed by the determination of the population. This is followed by a brief account of the research sample, methods used for selecting the respondents and a description of why these methods were used. The data collection methods and research tools that were used in this research are then explored. Thereafter a brief description on how the research instrument (questionnaire) was administered and a description of the method of data analysis are given. The chapter concludes by providing a concise portrayal of the ethical issues pertaining to the research.

3.1.1 Research design and rationale

According to McCaston (2005:1), "A research design is a step-by-step plan that guides data collection and analysis". The research will use a quantitative research design. According to Cohen, Manion & Morison (2000:4) "Quantitative research is a study involving the use and analyses of numerical data using statistical techniques". It poses questions of who, what, when, where, how much, how many, and how (ibid). Quantitative data typically is in numerical form such as averages, ratios or ranges (Leedy, & Ormord, J.E. 2005 & Ormord, 2005). The reason for using a quantitative research design is that data to be collected includes numbers and statistical information which must be presented in readable and interpretable forms e.g. bar graphs, pie charts, tables and line graphs (Sibanda, 2009; Babbie, 2013). Illustrations communicate quickly, are more revealing, have a more forceful impact, have a more lasting impression than written material and are more convincing than a discussion (Chilisa & Preece, 2005:125). A description of the research methodology follows.

3.2 Research methodology

3.2.1 Study area

The area of study for the research shall be secondary schools in the Groot Letaba circuit of Mopani District in the Limpopo Province of South Africa. This area is primarily rural and some schools are close to farms. All of the schools in the study area fall under Quintile one – the Department of Basic Education's classification category for no fee paying schools, due to the poverty level of the residents of the area in which the school is situated. There are no private/independent schools i.e. schools that are privately owned, governed and funded (DBE, 2012:11)) in this circuit. All these public high schools are in a rural area. Inhabitants of the villages where these schools are situated are mostly uneducated women, and young males who have either dropped out of school or who have passed Grade 12 but have no money to continue with their studies and/or cannot find work. Adult and/or elderly males who have retired from work on the mines and in factories in the cities (such as Johannesburg, Gravelotte and Phalaborwa) complete the list of inhabitants of these villages. Although poverty is rife in this area, there are villages such as Makhuva, Mageva and Ndhambi that show some signs of urbanisation. The Makhuva village for example has a community multipurpose centre (MPCC) where some essential government services are offered. Even though Mbaula, a village where Masiza Secondary School is situated, is poor, the school has been sponsored from its inception by Transnet.

3.2.2 Population

There are twelve secondary schools in Groot Letaba Circuit of Mopani district in the Limpopo Province, namely, Magulasavi, Makheto, Masiza, Bambeni, Xihlomule, Hikhensile, Nghonyama, Zava, Ndhambi, Sasekani, Makhwivirini and Nyumbhani . All of these public schools are situated in a rural area. These twelve schools constitute the population within which the research was conducted. Therefore, the research population comprises twelve (nine males and three females) principals and 200 teachers (104 females and 106 males). Although there cannot be teaching if learners are not present, learners and members of governing bodies fall outside the scope of this research. The research focuses mainly on teachers and principals.

3.2.3 Sample and selection method

According to De Vos (1998:190) cited in Amedzo, (2007:29), the term sampling means taking any portion of the population or the universe as a representative of that population or universe According to Brynard & Hanekom (2011:54), sampling is a technique employed to select a small group (the sample) with a view to determining the characteristics of a larger group (the population). If selected discerningly, the sample will display the same characteristics or properties as the larger group (the population). There is a view that determining specific properties of the whole population is like eating one slice of an apple: If the slice of an apple tests sweet, then the whole apple is judged to be sweet (Brynard & Hanekom (2011:54). But this is not always the case. For example, an apple might be half rotten. To get a representative of the whole apple you would therefore need to test the rotten part and the good part of the apple at the same time because neither part (rotten and not rotten) represents the test of the whole apple. This is the same dilemma the researcher had to deal with in the selection of the sample for this study. For example, there are twelve high schools in the Groot Letaba Circuit. All these schools are public and do not pay fees. The Groot Letaba Circuit is also generally rural and therefore all these schools are considered to be in a rural area. But public high schools in rural areas are not homogeneous in terms of management (some are better run than others), pass rate (some have better a pass rate than others), funding (all are generally publicly funded, but some schools such as Masiza have been sponsored from their inception by private companies such as Transnet (a South African rail, port and pipeline company), which adds some extra income to government funding). Others such as Magulasavi, Nghonyama and Nyumbani Secondary Schools are situated in an area which is generally rural but with some signs of urbanisation. However, the poverty level and the level of unemployment of the residents in these areas is still considered to be too high for these parents to contribute financially to the finances of these schools – hence all schools are no-fee-paying schools.

There is no guarantee that all these schools in rural areas will have the same ICT problems. There is also no guarantee that these secondary schools would use their ICT equipment in the same way. The literature has shown that the integration of ICT in teaching and learning at school level depends on many factors, including the motivation from school management (Yee (2000) cited in Makewa et al, 2013:50), the availability of teachers who are well qualified in terms of the subjects they teach,, teachers' skills and motivation to use ICT in

their teaching and learning. No two schools are the same. Therefore, the researcher was fully aware that a random sampling would have increased the chance for every member of the population to have an equal chance to be selected and included in the sample and that pure chance is the only factor that determines who eventually gets into the sample (Amedzo, 2007:30). The researcher was not entirely convinced that it was possible to select a representative sample that included all the nuances and differences between high schools in the Groot Letaba Circuit. In addition, stratified sampling was considered for selecting the representative sample for this study. This is a method of sampling which divide the population into different, clearly recognisable sub-populations or strata (Brynard & Hannekom, 2011:56). For the purpose of this research, stratification was used to categorise gender in terms of male and female respondents.

There is a general consensus that the purpose of using samples in the study is to simplify the research (it is easier to study a representative sample of a population than to study the entire population), but this is only when studying the entire population is too costly or time-consuming or the entire population is too large to be studied entirely (Mugo, 2002:2). Thus, in the absence of information on objective factors before the actual survey, the researcher decided not to sacrifice accuracy and reliability for the sake of convenience and savings that a smaller research samples would provide. Luckily, the entire population of this study consists of only twelve schools and they are all in the Groot Letaba Circuit in Limpopo. Taking into account the consensus among the researchers that larger samples are more likely to yield results that are more reliable, precise and representative of the population, (Kalton, (1983) cited by University of Texas, 2011:1), as well as the absence of preliminary information about the existence and use of ICT in the secondary schools in the Groot Letaba Circuit, the researcher decided to include all schools in the study. The researcher believes that including all the high schools minimised the possible sampling errors and researcher biases. Sampling error is an error that results solely from the manner in which the researcher decides to select his/her participants or observations (Mugo, 2002:5). However, while the intention of the researcher was to solicit responses from all secondary school teachers (from Grade 8 to Grade 12) and principals of these twelve schools in the Groot Letaba Circuit (a total of 222 participants), only 146 responded to and returned the questionnaires.

The table below shows that nine out of twelve high school principals who were selected to participate in this research were male and that three were female. Seven of the respondents

did not indicate their gender on the completed questionnaire. It also shows that 106 females and 104 males were selected to participate in this study. In terms of race, all of them are black. However, in terms of those who chose to willingly participate in this research, only 75 (54.8%) males and 64 (46%) females returned their questionnaires. Only two (out of nine) male principals and two (out of three) female principals chose to return the completed questionnaires. Thus, in total, 146 (out of 222) people selected to participate in this research responded and returned the completed questionnaires to the researcher. One hundred and forty-six participants out of a total number of 222 teachers in the participating secondary schools in the Groot Letaba Circuit represented 66 % response rate and the sample chosen is representative enough to represent the population. In terms of age, the majority (51.4%) of respondents were between 41 and 50 years old, 32.6% were under 40 years of age while 15.9% were above 50 years old. The respondents covered all grades of high school in South Africa, from Grade 8 to Grade 12. A large number of respondents (82%) are ordinary teachers (also known as level 1 or CS1 teachers). About 10% are Heads of Departments (HODs) (also known as CS2 teachers) with 8% comprising both Deputy Principals (SC3) and Principals (also known as CS4). This description is summarised in the following table.

Table 7: Summary of respondents per schools

Name of schools	Number of principals		Number of teachers at school		Racial division	**Total**	Number of teachers who responded to the questionnaires PER SCHOOL		Number of principals who responded to the questionnaires PER SCHOOL		**TOTAL**
12 Schools	Male	Females	Male	Females	Black		Male	Female	Male	Female	
Magulasavi	1	-	7	16	24	24	5	14	-		19
Makheto		1	4	4	9	9	4	4		1	9
Masiza	1	-	7	15	23	23	4	10	-		14
Bambeni	-	1	3	5	9	9	3	2		-	5
Xihlomule	1	-	4	6	11	11	4	4	1		9
Hikhensile	1	-	8	4	13	13	7	4	-		11
Nghonyama	1	-	20	18	39	39	15	2	-		17
Zava	1	-	10	4	15	15	7	5	1		13
Ndhambi	1	-	13	5	19	19	9	5	-		14
Sasekani	1	-	8	11	20	20	4	6	-		10
Makhwivirini	-	1	5	3	9	9	2	3		1	6
Nyumbhani	1	-	17	13	31	31	9	3	-		12
SUB-TOTAL	**9**	**3**	**106**	**104**	**222**	**222**	**73**	**62**	**2**	**2**	**139***
SAMPLE TOTAL	** 7 respondents did not indicate their gender on the questionnaire*						**73**	**62**	**2**	**2**	**146**

Table7 created by the researcher

3.2.4 Data collection methods

According to Brynard and Hanekom (2011:54), data collection refers to the collection of information to be used in the investigation. Mouton and Marais (1992: ix) advocate that specific methods and techniques which are deemed appropriate be identified and applied so that a researcher is able to reach valid research findings. Auriacombe (2001: 51) suggests that more than one strategy or source may be used in collecting data for a particular research question. The combination of data collection methods helps to verify information and can lead to richer outcomes, while the choice of data collection method depends on the information the researcher needs in order to achieve his or her evaluation objectives ((Behrman, 2006:1; World Bank, 2008:3). This research used two types of data, namely, primary and secondary data in order to achieve the objectives of this research.

According to McCaston (2005:1) secondary data analysis can be literally defined as "second-hand" analysis. It is the analysis of data or information that was either gathered by someone else (e.g., researchers, institutions, other NGOs, etc.) or for some other purpose than the one currently being considered, or often a combination of the two (Cnossen 1997 cited in McCaston 2005:1). The most common sources of secondary data for this research were government documents, official statistics, technical reports, scholarly journals, trade journals, review articles, reference books, research institutions and universities, libraries and library search engines, computerised databases, the World Wide Web (WWW) and reports of international organisations such as UNESCO (Shell 1997; McCaston 2005:3).

Primary data refers to the data which is obtained from the original source (or first-hand experience). Primary data which is used in research is originally obtained through the direct efforts of the researcher through surveys, interviews and direct observation (Brynard & Hannekom, 2011). For the purpose of this research, primary data was collected from the participants selected from the twelve high schools in the Groot Letaba Circuit by means of questionnaires. A detailed description of these two data collection methods used in this study is presented in the following sections.

3.2.4.1 Questionnaires

A questionnaire is a set of questions for gathering information from individuals (Department of Health and Human Services, 2008:1). Data was collected using questionnaires, firstly to gather demographic details of teachers and principals, secondly to determine the presence of technological gadgets (equipment) at selected schools. Questionnaires were used to

determine the ways in which this ICT equipment assisted teachers in the delivery of the curriculum. Questionnaires were used to gather information about the obstacles preventing the uptake and to gather information on training and its impact on teaching.

Some other advantages of using questionnaires to collect data include that they generate a lot of quantitative data and that this method is relatively inexpensive. Most items on the questionnaires are also easy to score because they are standardised. Most importantly, responses must be confidential and anonymous (Chilisa & Preece, 2005:115). However, in as much as the questionnaire has benefits, there are some disadvantages that the researcher must take care of in order to increase its validity. These include that research may be delayed because participants respond in their own time. The researcher dealt with this challenge by appealing to the respondents to make every effort to respond within a month of their receipt of the questionnaires. The researcher also did whatever possible to remind participants about the need to respond in good time to avoid delaying the research process. Another disadvantage is that the researcher using questionnaires to collect data prevents probing to get further clarification from the respondents. The researcher attempted to minimise the impact of this problem by making sure that the questionnaire included questions that covered as many aspects of the research questions as possible. The fact that questionnaires can only be completed by literate people did not have an effect on this research because all educators at high schools are considered literate. Finally, the fact that questionnaires are generally associated with low return rate (Chilisa & Preece, 2005:115) has been dealt with by reminding the respondents (who willingly participated in this research) about the importance of their participation.

3.2.4.2 Administration of the questionnaire

You can administer questionnaires by mail, telephone, using face-to-face interviews, as hand-outs or electronically (i.e., by e-mail or through web-based questionnaires) (Department of Health and Human Services, 2008:1). Therefore, after having considered all the merits of different methods of administering the research questionnaires the researcher decided to hand-deliver all the questionnaires to all participants in the twelve participating high schools. Hand-delivering the questionnaires to the respondents had the benefits of meeting them face-to-face and establishing a positive vibe. Hand-delivering the questionnaires to the research participants also helped the researcher to communicate the purpose of the questionnaires,

how the researcher planned to use the data, and how the results would help participants. All of these are likely to increase the chance of getting a high response rate.

After receiving the appropriate authorisations from the participating school principals and the signed consent forms from the participants, the researcher personally hand-delivered all the questionnaires to each respondent at their work-places. This prevented possible delays resulting from posting questionnaires and also established a good relationship with the respondents. Since the researcher is a high school teacher himself, this personal touch was appreciated by the respondents. The researcher also did whatever possible to keep regular contact with the respondents, in order to personally collect all the completed questionnaires directly from the respondents' hands. Regular school visits and formal meetings with school principals (all of whom have been supportive of this research) have also been conducted in order to facilitate initial support by the schools, to prepare for the undertaking and to collect completed questionnaires. This was necessary in order to ensure anonymity and avoid third-party access to the data collected by the researcher. Additionally other methods of communication such as e-mail and cellphones have been regularly used to clarify any necessary matters and to maintain speedy progress in terms of completion and collection of questionnaires.

3.2.4.3 Literature survey

The collection of secondary data was based on literature review. According to Bush et al (2006:3), the literature review involves a thorough and critical review of existing literature. For the purpose of this research, the literature review involved a thorough and critical review of existing literature on the effects of the use of Information Communication Technology by teachers in secondary schools. The literature review included works published internationally and in South Africa and comprised books, articles in newspapers and academic journals, records, departmental audit reports, policies and statistics and master's and doctoral theses. Internet data on the use of ICT in teaching and learning were also reviewed.

3.2.5 Data analysis methods

Analysis of data was based on the type of data gathered. Since the research design was mainly quantitative, the primary data collected was analysed quantitatively. For the purpose of this research, a statistical software programme, namely the Statistical Package for the Social Sciences (SPSS), was used to analyse the first-hand/primary data gathered during this

research. Prior to analysis of the primary data, the data was scanned and organised by the researcher. The researcher used various ways, namely tables and graphs, to present the results of primary data. Finally, secondary data was analysed by means of an in-depth critical evaluation of current literature in the field of using ICT in teaching and learning.

3.2.5.1 Validity and reliability of the measuring instruments

According to Miller (2011:1), "The two most important and fundamental characteristics of any measurement procedure are reliability and validity". According to McMillan and Schumacher (2010), validity refers to the degree of congruence between the explanations of the phenomena and the realities of the world while reliability measures the replicability of the results. Steps to ensure the validity of the research instruments included piloting the research questionnaires to a few high school teachers to find out if the wording on it was clear enough to avoid confusion. Suggestions from these teachers were used to improve clarity of the questions. According to Miller (2011:1), reliability is defined as "the extent to which a questionnaire, test, observation or any measurement procedure produces the same results on repeated trials. In short, it is the stability or consistency of scores over time or across raters". Miller (2011:1) further states that it is very important to: "Keep in mind that reliability pertains to scores, not people. Thus, in research we would never say that someone was reliable". For the purpose of this research, the researcher was aware that the validity of the findings might have been affected by the fact that the data were self-reported by teachers. Questionnaires also have the danger of respondents not telling you the truth but what they think you want to hear. The researcher made sure he minimised the effects of these two problems by encouraging respondents to be as truthful as possible in their responses. However, since this research was conducted specifically in high/secondary schools of the Groot Letaba Circuit in Limpopo, the findings of this research cannot be generalised to the whole province or the whole country. Thus, the response rate of 66% makes the study reliable and generalisable to all the high schools in the Groot Letaba Circuit.

3.2.6 Ethical considerations

According to Babbie (2007:118), ethics is a matter associated with morality; in research, certain ethical guidelines serve as the standard which forms the basis for evaluating the conduct of the researcher. According to Resnik (2011:1), ethics in research are norms for conduct that distinguish between acceptable and unacceptable behaviour of researchers. This

research was conducted with integrity, honesty and truthfulness. The researcher sought fully informed consent from the Department of Basic Education, from the schools where research was to be conducted, and from the teachers who were to complete the questionnaires. The researcher also ensured the privacy of and anonymity of the participants, as well as the privacy of the data, in a responsible and sensible manner as per the ethical prescriptions of academic research. Furthermore, the researcher informed participants about their right to withdraw from participation at any time. Participants were informed of their right not to complete or return the questionnaires if they wished to and, finally, the researcher exercised sensitivity regarding information offered by participants. In order to increase the level of trust, the researcher revealed his identity and background fully (Marion & Morrison, 2004). The research posed no physical, emotional, intellectual or social threat to the respondents, the community, or the environment. Since all the twelve schools in the Groot Letaba Circuit participated in the research, it was critical to protect their privacy. In order to protect respondents' privacy, no response was directly linked to a particular school or specific respondents in the analysis and reporting of this research.

3.2.7 Limitations of the study

Generalisation of the research findings can be limited by some factors the researcher encountered. Firstly the study area was small. It was limited to the Groot Letaba Circuit, not to the whole province or country. Although small, the researcher believes the scenario painted by the findings is relatively relevant to most schools in the Mopani District in particular and the Limpopo Province in general. Secondly some respondents were reluctant to participate in the survey.

3.3 Conclusion

This chapter describes the research design that was followed in this study. The chapter begins with a description of the research design that was followed in the study, followed by an outline of the rationale of the research. The study area is mapped out followed by the determination of the population. This is followed by a brief account of the research sample and the methods used for selecting the respondents and a description of why these methods were used. The data collection methods and research tools that were used in this research are then mentioned and explored. Thereafter a brief description on how the research instrument (questionnaire) was administered is given. This is followed by a description of the method of

data analysis and the reliability and validity of the measuring instruments. The chapter concludes by providing a concise portrayal of the ethical issues pertaining to the research and the factors that limit the generalisation of the findings. The following chapter is the presentation, analysis and interpretation of data.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The previous chapter focussed on explaining the research methodology, the sampling methods and the process to be followed in eliciting, capturing, analysing and interpreting the data. This chapter discusses the findings of the survey conducted at the twelve schools that participated in this study. The primary purpose of the study was to investigate the presence of ICT tools and equipment in selected secondary schools, to analyse the frequency of use of ICT by teachers in teaching and learning, to analyse the effects/impact of the use or non-use of technology by teachers and principals on teaching and learning, to analyse the impact of ICT training or the lack of it on teachers and principals with regard to ICT use and, finally, to analyse the factors hindering teachers' readiness and confidence in using ICT. To achieve these objectives, a structured questionnaire was designed and used to collect data from participants selected from high/secondary schools in the Groot Letaba Circuit. Following is the statistical analysis and the findings.

4.2 Respondents' profiles

4.2.1 Gender and age of respondents

A total number of 146 respondents out of 210 teachers and twelve principals in the twelve secondary schools in the Groot Letaba Circuit completed and returned their questionnaires to the researcher. This is approximately 66% of the response rate. About 64 (44%) of these respondents were females and 75 (55%) were males. Seven (approximately 5%) of the respondents did not indicate their gender.

In terms of age, the majority (51.4%) of respondents were between 41 and 50 years old while those in the age range between 31 and 40 constituted 27.5% of the respondents. The youngest participants were between 21 and 31 years old (5.0%), while the oldest (16%) of the participants were over 50 years old. The fact that the majority (67.3%) of respondents were older than 40 years old (i.e. born around the 1970s) and the oldest (15.9%) of the participants were over 50 years old (i.e. born around the 1950s/60s) is an indication that the majority of the participants had many years of teaching experience. However, this age range could also affect negatively the ability to use ICT because the older the people, the less likely they are to

have the ability to use ICT. According to Mpinganjira and Mbango (2013:39), while "young people of today are undoubtedly growing up in a technological environment" this was not the case for their parents or most people who studied their primary and high school levels prior to mid-1990's (Mpinganjira & Mbango (2013:39). It is thus not surprising that many studies such as Kolodinsky, Hogarth, and Hilgert (2004) and Naseri and Elliot (2011) report higher usage levels of Internet among younger people than among older people (Naseri and Elliot, 2011; Kolodinsky et al, 2004). The fact that only 32.6% (5.1% and 27.5%) of the respondents were less than 40 years old and 67.3% (51.4% and 15.9%) respondents were between 40 and older suggests an aging teacher workforce in the Groot Letaba Circuit and that there are very few young teachers entering the system in this circuit. The fact that few young people are entering the teaching profession may explain the lower rate of ICT use in this circuit as the following paragraphs of this research will show. Figure 2 represents a summary of the age ranges of the respondents.

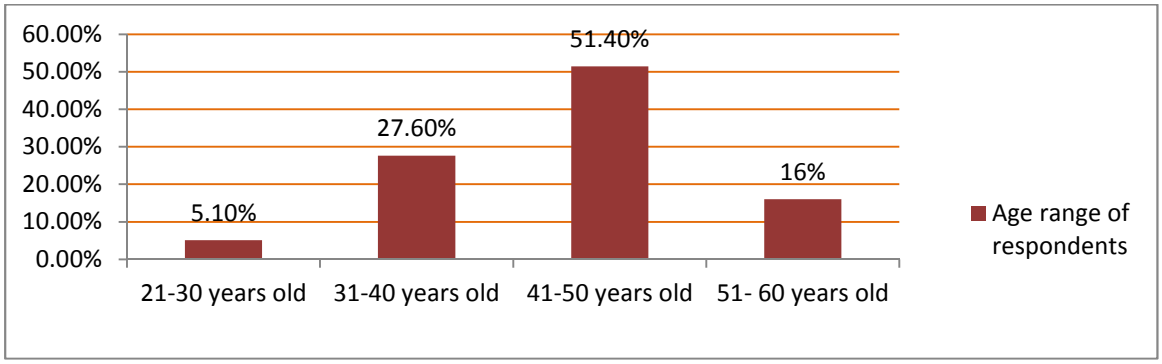

Figure 2: Age range of respondents

Source: Figure 2 created by the researcher

4.2.2 Teaching experience

In terms of teaching experience, the majority of the teachers (43%) had more than fifteen years of teaching experience and 26% of them had worked between six and ten years. That is, a large majority (69%) of respondents had been in the teaching profession for more than ten years. The rest, about 31%, had teaching experience, of between one and fifteen years. Among this group were 16% whose teaching experience ranges from eleven to fifteen years, only 11% had two to five years teaching experience and about 4% had less than a year of teaching experience. However, while the aging teaching workforce might have had many years of teaching experience, these two factors (both aging and many years of experience) may suggest that the majority of the teachers in the Groot Letaba Circuit might have received

their teaching training before ICT was widely used and therefore might not have received ICT training as part of their professional teaching training. Lack of ICT training as part of teachers' training of this aging workforce in the Groot Letaba Circuit might also explain the low usage of ICT in teaching and learning at secondary schools in this circuit as the following paragraphs will show.

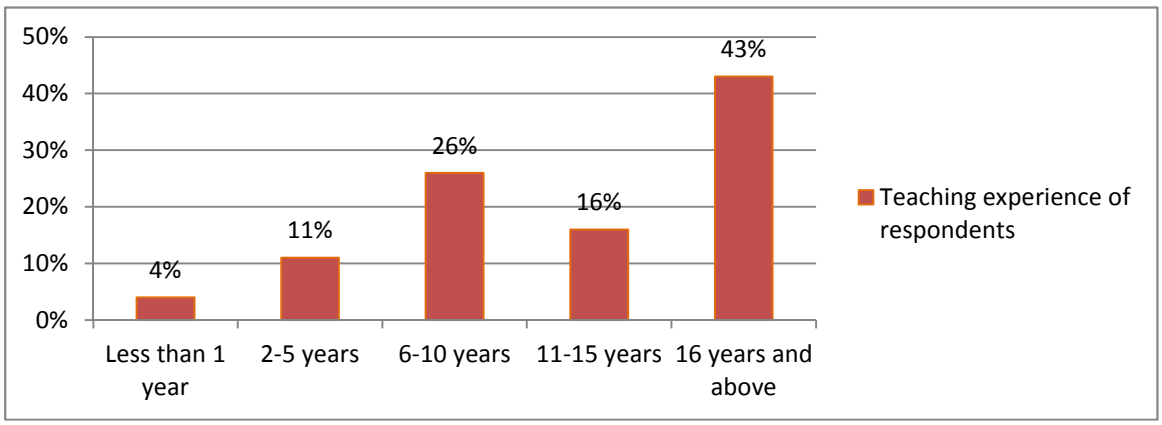

Figure 3: Teaching experience of respondents
Source: Figure 3 created by the researcher

4.2.3 Highest academic qualification of respondents

As far as the qualification of the respondents was concerned, at least 42% of the respondents had acquired a post-matriculation qualification with three year diplomas in teaching and 39% of the respondents had obtained a Bachelor's degree. Of these 39% with a Bachelor's degree, about 22% had obtained post-graduate qualifications on top of their teaching qualifications. These include 15% who had Honours degrees and 3.6% whose qualifications were classified as "other". There was no one with a Master's or Doctoral degree. The following Figure 4 shows that almost half of the teachers in the Greater Letaba Circuit had teaching diplomas and certificates as their highest qualifications, while the other half had Bachelor's degrees and other qualifications such as Honours and Master's degrees.

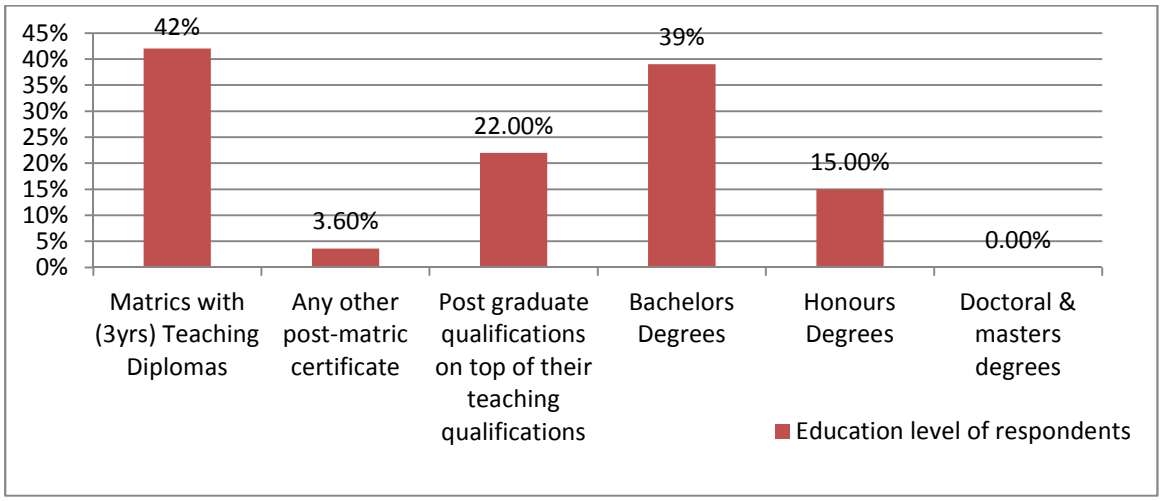

Figure 4: Academic qualification of respondents

Source: Figure 4 created by the researcher Within Figure above – degrees (lower case), Master's, Bachelor's,

4.2.4 Main subject taught

About 6.9% of respondents taught commercial subjects, namely Business Studies, Economics and Accounting, 14.5% of respondents taught Mathematics and Physical Sciences while 15.9% of respondents offered languages in the form of English and Xitsonga. The sciences, namely, Agriculture, Natural Sciences and Life Sciences, were offered by 6.3% of respondents. History and Geography were taught by 4.9% of the respondents while Technology was taught by 2.7%. About 1.4% taught Tourism and Consumer Studies. About 47.4% of the respondents did not indicate which subject on the questionnaire they taught. Given the fact that 42% of the respondents had a matric certificate and a teaching diploma as their highest qualification, the high percentage of people who did not want to disclose the subject they taught might have been an indication that some respondents may not have wanted the subjects to be known so as to avoid negative judgements that might have ensued after such disclosures. This was confirmed in the follow-up interview with one of the members of the circuit management team on Tuesday, 10 December 2013.

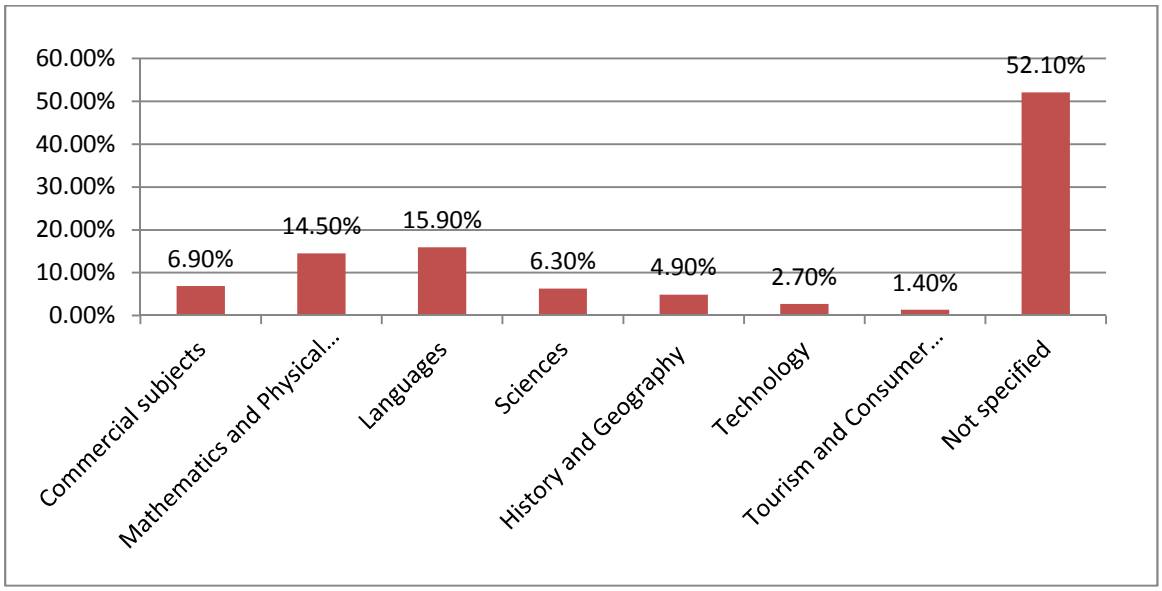

Figure 5: Summary of main subjects taught
Source: Figure 5 created by the researcher

4.2.5 Current job level in the Department of Education

The researcher wanted to find out about the current job level of teachers and principals who participated in this research. An analysis of the responses showed that a total number of six (4.1%) principals (also known as CS4) and five (3.4%) deputy principals (also known as CS3) responded to the questionnaires. These two categories constituted 7.5% of the total respondents. In addition, fourteen (9.5%) heads of departments and 113 ordinary teachers (i.e. CS1 or level 1 teachers who had not been promoted to any school management position) (77%) responded. Eight teachers or 5.5% of the respondents did not respond to the question. Figure 6 summarises the job levels held by respondents at the time the questionnaire was administered.

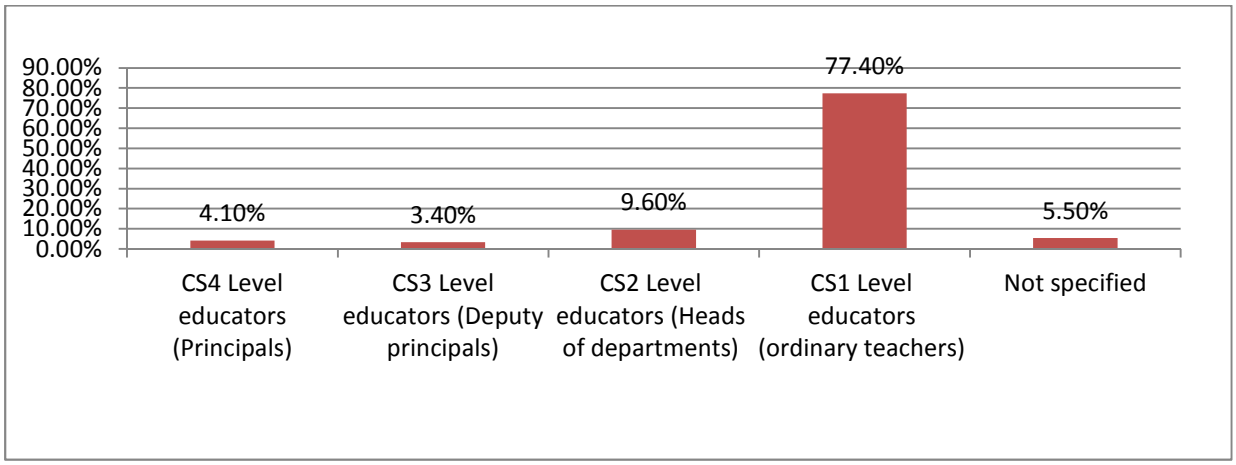

Figure 6: Summary of current job level held by respondents in participating schools
Source: Figure 6 created by the researcher

4.2.6 Professional ICT qualifications

An analysis of the responses showed that at least 41% of the respondents had a professional ICT qualification (certificate, diploma etc.). However, the results also showed that the majority of respondents (59%) did not have any ICT qualification. It is possible that not having an ICT qualification might not mean that a person had no knowledge about how to use ICT. However, the fact that the majority of the educators were in their late 40s (as seen in Figure 2) and the fact that the majority of the people surveyed did not have any professional ICT qualifications should be a serious cause for concern for the national and provincial Department of Education, but more specifically for the schools concerned because the majority of these educators may not have been able to use the ICT which was available to their schools. Figure 7 summarises the ICT qualifications of respondents.

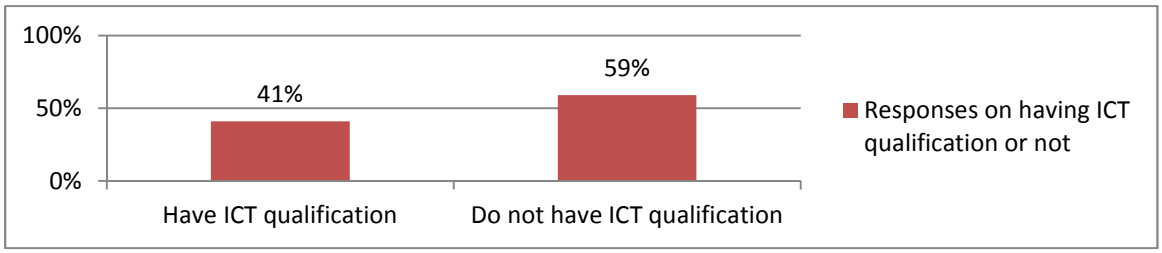

Figure 7: Professional ICT qualifications
Source: Figure 7 created by the researcher

4.3 ICT and its impact on teaching and learning

Literature in Chapter 2 has shown that ICT has an impact on improving learning and teaching. Therefore the researcher wanted to find out if the teachers from participating high schools also thought that ICT has an impact on teaching. The findings show that 55.1% of the respondents agreed or strongly agreed that ICT had an impact on their teaching. However, 25% of the respondents disagreed or strongly disagreed with the statement, suggesting that that they thought that ICT does not have an impact on teaching and learning. The findings, however, show a substantial level of confusion among educators who participated in this research on whether ICT impacts on teaching and learning. Approximately 19.9% of the respondents were not sure if ICT impacts or not on their teaching and their learners' learning. This observation suggested the need for increased awareness of the increasingly importance of ICT in teaching and learning across the globe. Figure 8 summarises the views of respondents on the impact of ICT on teaching.

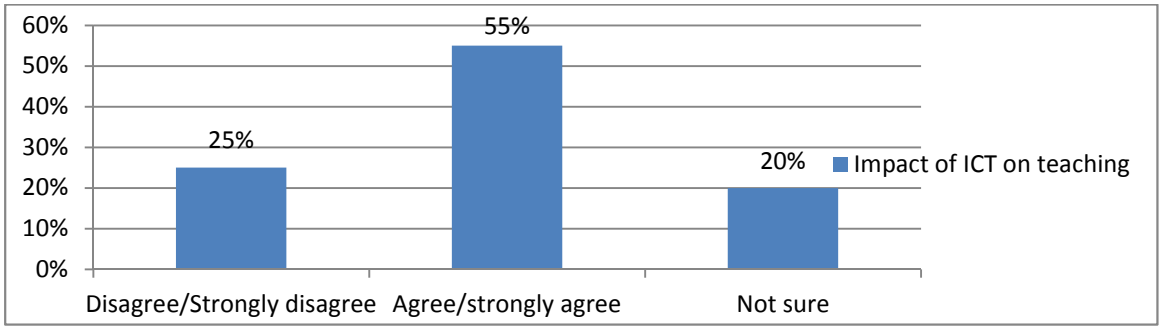

Figure 8: Impact of ICT on teaching
Source: Figure 8 created by the researcher

4.3.1 ICT training for school teachers

It has been argued in the literature that the deployment of ICTs in secondary schools, including training of teachers in the use of ICTs, will enable South Africa to use limited resources, including teachers, more effectively to accomplish the goals of improved secondary education and human resource development (Evoh, 2007:8). Therefore the researcher wanted to find out the status of respondents' ICT training in the circuit. The results are briefly discussed in the following paragraphs.

4.3.1.1 Different types of ICT training received

Participants in this research were asked to indicate if they had received any computer training and, if they did, what type of computer training they had received. The result of the survey indicated that 59% of the respondents had received basic computer literacy training (on how to turn computer on/ off, loading software etc.). It is very important to note that the same number of teachers who reported not having any professional ICT training certificate in the previous paragraph also indicated that the in-service ICT training they had received was very basic and did not equip them with the skills they needed to use the basic ICT available at some schools (i.e. the computer). They were only trained on: "how to turn computer on/ off, loading software", not how to use computers to prepare slides or to download from the Internet any other course material they needed to teach. Few respondents (7.3%) had been trained on Electronic Communication Device (ECD) and computer integrations and 1.4% of respondents had been trained in programs such as Microsoft. The fact that only a few of the respondents had been trained explains why so few of them were able to use ICT to teach their learners. Basic computer literacy which a few teachers had received did not adequately prepare teachers to meaningfully or effectively use ICT to teach.

4.3.1.2 Reasons for undertaking ICT training

Besides asking respondents to indicate which ICT training they had received, the researcher also wanted to probe the motivating factors of those who decided to undertake training. The findings indicate that (42.3%) of the respondents enrolled for computer training to increase career prospects while 34.2% of the respondents wanted computer skills for personal interest. Thus, a sizeable 77% of the respondents underwent computer training for reasons other than using their skills to improve teaching and learning. Only 11% of the respondents said they undertook ICT training with the objective of using it to improve their teaching and learning in their classes. However, perhaps the biggest problem is that the school management (and possibly the Department of Basic Education at national and provincial levels) do not encourage their educators to acquire ICT skills. This weakness is well demonstrated by the fact that only 6% of the respondents were required by the management of their schools to go for computer training. The other noticeable problem is that the focus seems to be on computer training as though computers are the only ICT used in teaching and learning. While all the respondents who said they took up training went for computer training, no respondents mentioned other ICTs such as how to use the interactive white board (Smartboards), how to

use Mixit or any other ICT to enhance teaching and learning. It could be argued that the focus on computers training could be linked to the on-going Teacher Laptop Initiative (TLI) initiated by the Department of Basic Education early in 2009. This explains also why some educators who indicated that they did enrol for ICT training, did so in order to increase their career prospects, or went there on the request of their schools, and why only a very small fraction of educators wanted to use ICT in class.

4.3.1.3 Number of years since the last ICT training of any kind

The researcher wanted to find out if those who, for whatever reason, had attended any ICT training had continued to update their ICT skills over the years. The findings indicated that more than two-thirds of the respondents (76.2%) who had attended computer training did so between zero and five years ago. The zero to five year's period coincides well with the TLI era. As discussed above, Ms Naledi Pandor, former Minister of Education (now Minister of Home Affairs), ratified regulations for the Teacher Laptop Initiative in 2009 (i.e. four years ago) (see also Africa, 2009:1). However, 24% of those who had received any kind of ICT training seemed to have done so more than five years before. This indicates that once teachers have graduated from colleges and universities, they become confined to the classroom and usually do not keep up with new developments in their field or area of specialisation. Thus there is no guarantee that the 76% who received their ICT training between zero and five years ago would go for further ICT training to increase their ICT skills or to update their ICT knowledge. There is therefore a need for refresher courses on how to use computers, since the majority of the respondents had been trained more than five years ago. Such on-site refresher courses are vital for teachers who wish to use ICT in teaching and learning, because there have been many new developments since they last had their training in ICT.

4.3.1.4 Impact of training received on teaching

The researcher wanted to find out whether some of the ICT training received by the educators was actually helping them to improve teaching and learning in their classrooms. The findings indicate that 59% of the respondents who had received ICT training said that the training they received had benefited them. The problem however, is that as many as 41% stated that the ICT training was not sufficient to help them discharge or improve their teaching responsibilities and, as such, they did not use ICT in their teaching and learning. In fact, there were also about 41% of the respondents who said they were not sure of the benefits received

from the training they had attended. Therefore, while it seems like the majority of respondents (59%) had received some sort of ICT training, fewer educators actually benefited from using their ICT skills in their own teaching. Hence, more than 40% of the teachers surveyed did not believe that ICT skills they received had impacted on their teaching. Reasons for the status quo may vary. Firstly, it may be possible that even those teachers who have the ability to use ICT are not using it at all (either because they had no ICT equipment at school, or were not motivated/encouraged to use it by the schools' leadership). Finally, the low to negative attitude of ICT benefits in teaching and learning among the teachers surveyed may indicate lack of proper training programmes, methods and approaches. There is currently no known scientific and systematic research on the appropriateness and effectiveness of ICT training provided to high school teachers in South Africa.

4.3.1.5 Person responsible for financing the computer training

The researcher wanted to find out if high school teachers received some financial support to attend ICT training once they were in the employ of the Department of Basic Education. Respondents were asked to indicate who financed teachers' computer training courses in their schools. The results showed that nearly three-quarters (73%) of the respondents had financed their own computer training courses and had received no financial support to attend ICT training. Only 17% indicated that the training had been paid for either by the Department of Basic Education or the school. About 10% indicated that their ICT training had been financed by donors. Thus, the ICT training of about 27% of the respondents had been paid for by the DoBE or private or charitable donors. The fact that most teachers who had attended an ICT training course had had to finance their own training could explain why few teachers had received ICT training after getting employed at the schools who participated in this research. It could also explain why those who had received ICT training five or more years previously had not bothered going back to update their ICT skills. Lack of continuous ICT training is a barrier to ICT usage in teaching and learning, because, while ICT changes continually, the teachers' skills and knowledge had not kept up with these improvements. Lack of continuous training could also explain why few teachers in the schools who participated in this research did actually use ICT in the teaching and learning; they lacked confidence in implementing ICT in their schools as the following paragraph clearly shows.

4.3.1.6 Teachers' level of confidence in implementing ICTs in the classroom

The researcher wanted to find out if the teachers who had received ICT training were confident enough to use ICT to perform their classroom work. The findings of this research point to the general low level of confidence among all teachers. Only 47% of the respondents reported having some confidence in the implementation of ICT in the classroom. However, more than half (53%) of the respondents reported that they had no confidence at all or that they had little confidence in the implementation of ICT in the classroom. These findings paint a gloomy picture because teachers who are not confident in using ICT are not likely to use it to improve their teaching and learning in the classroom. The need to increase the teachers' level of confidence in using ICT in teaching and learning cannot be over- emphasised. However, the negative impact of teachers' lack of confidence in the teaching and learning falls beyond the scope of this study; it certainly needs to be properly studied by other researchers.

4.3.1.7 Teachers' computer use at home and level of experience with computers

The researcher believed that the use of computers and other ICT at home could increase teachers' skills and confidence. Thus, the researcher wanted to find out whether any of the high school teachers who participated in this research did actually use ICT equipment (especially computers) outside their work environment. The findings show that 54% of the respondents did use the computer occasionally or frequently outside their work environment. However, 46% of respondents reported to either rarely or never use a computer at home. While the researcher does not seek to imply that the high percentage of people who reported to rarely or never use computers at home do not necessarily lack access to them at home, the results are in line with other researches such as Statistics SA which found that only 12.4% of the 1 418 102 households in Limpopo Province and about 11.1% of the 296 320 households in the Mopani District where the Groot Letaba Circuit is situated, had access to their own computers (Statistics South Africa, 2012). The fact that a high percentage of teachers rarely or never use computers is worrying because it has a negative impact on the teachers' level of experience with computers. Only 39.1% of the respondents indicated that they had a good or excellent knowledge of computers. However, as high as 60.9% of the respondents indicated that they had moderate to poor knowledge or skills on computers. This is a disappointing

finding because, if teachers have less experience with computers, it affects their confidence and readiness to use ICT to enhance teaching and learning.

4.3.2 Summary

Almost 60% of teachers surveyed had received basic computer training. Although this training offered those who received it minimal computer knowledge, it can provide a springboard for a mass rollout of computer training to teachers. However, what is disturbing from the findings above is that the majority of teachers trained were primarily motivated by increasing their career prospects and for personal interest rather than gaining knowledge for ICT integration in class. Moreover the training received happened many years previously. Given the dynamism of the world of technology, the knowledge received may be obsolete. It is heartwarming to note, however, that more teachers trained in ICT have attested to its impact on teaching and learning. What is disconcerting, though, is that a high percentage of these teachers have financed their own training. This has serious implications for ICT integration in schools. More than 50% of teachers use computers at home. This increases their practical experience with computers.

4.4 Availability and usage of ICT equipments at schools

The researcher wanted to find out the status of availability of ICT at schools. The findings are summarised in the following Table 8.

Table 8: Availability of ICT in schools

Type of ICT equipment	Available	Not available
Photocopier machines	88	7.5
Laptop/Desktop Computer	77.4	17.8
Data Projector	39.2	62
Interactive Whiteboard	15	80
Word Processing	22	73
Internet	12	83.6
Digital Camera	12	83
TV	59	36.3
CD/DVD player	36	59.6
Radio	25	70.5
Any other form of ICT equipment	0	0

Table 8 created by the researcher

Table 8 above shows that the majority (88%) of the respondents indicated they had photocopiers at their schools. This high prevalence may be because principals and SMT need them for duplicating tests and exams papers, projects and assignments. However, there is evidence that some schools have photocopy machines but use them erratically, or never use them at all. For example, while 88% of the respondents reported having photocopy machines, only 62% of the respondents had used the photocopier regularly, 18.5% had used photocopy machines sometimes, and 15% had rarely or never used them. The fact that some schools do not have a photocopy machine or have them but never use them is cause for concern and raises questions about how these schools manage to prepare exams and test papers without them.

With regard to computers, Table 8 shows that 77.4% of the respondents indicated that their schools had computers available for them to use. Only 18% indicated that they did not have computers at school. However, while the results also show that while 77.4% of respondents reported having computers at schools, that availability did not translate into use. An investigation into the use of these computers produces dismal results. Only 62% of teachers used a computer, less than one-third (32%) used it regularly with 30% using it sometimes. About 28.1% had either rarely or never used a computer. This can be attributed to the insufficient number of computers at schools which teachers have to share. The fact that about 69% of schools have between zero and five computers is worrying. It could however also mean that teachers do not use computers because they are just not able to.

Table 8 also shows that 62% of the respondents indicated that data projectors were not available at their schools. Only 39.2% said that data projectors were available at their schools. The low level of availability of data projectors explains why few respondents have used them. About 61% of the respondents surveyed had rarely or never used a data projector. At least 7% of the respondents had used one regularly with 7.5% of the respondents using it sometimes.

Table 8 also shows that 80% of respondents indicated that interactive whiteboards were not available at their schools. It is concerning that only 15% of the respondents indicated that interactive whiteboards were available. Once again, the fact that few schools have interactive whiteboards explains the low usage of this equipment. About 59% of the respondents said they had rarely or never used an interactive whiteboard. As low as 4.1% had used it

sometimes and only 7% of the respondents said they had used interactive whiteboard regularly. The fact that 30.1% of the respondents did not respond to this question may suggest a lack of popularity of interactive whiteboards in the schools that participated in this research.

Table 8 also shows that the majority of teachers surveyed (73%) did not have word processors at their schools. Only 22% indicated that word processors were available at their schools. Furthermore, Table 8 shows that many of the schools surveyed did not have Internet. For example, 84% of respondents indicated that Internet was not available at their schools compared to only 12% who responded that they had Internet access in their schools. In an era where schools and teachers should be communicating electronically, the absence of Internet poses a serious problem. The implication is that principals have to travel to circuit offices to collect circulars – a waste of time and limited funds. The content of the circulars they are collecting may have expired by the time they go to the circuit office. Schools are then forced to communicate with the outside world predominantly by post which is slow and unreliable. Table 8 shows that digital cameras are found in a small number of schools. Only 11.6% of the respondents said they had them, while 83% of respondents indicated that digital cameras were not available.

In addition, almost 60% of the teachers surveyed (59%) indicated that TV's were available but 36.3% indicated their unavailability. However, the data collected suggests that those schools which had TV's and such equipment did not necessarily use them regularly. Only 9% of respondents had used a TV regularly whereas 16.4% had used it sometimes. About 18% and 35% respectively had rarely or never used it. Again, the fact that as many as 22% of the respondents did not want to respond to this question suggests lack of popularity in using TVs as tools for teaching and learning in the participating schools. The high percentage of the respondents indicated that TV was rarely or never used at school. The implication is that educational programmes offered by SABC and other institutions to support learners are not accessible and so learners are missing valuable information in subjects such as Mathematics and Science.

CD/DVD player were not available in 60% of schools in comparison to the 36% who indicated their availability. However, the availability of such equipment does not suggest that those who have them actually do use them in teaching. About 55.2% of the respondents had

rarely or never used a CD/DVD player. So despite the Department of Education sending DVDs and discs for subjects like Life Orientation and English for learners to watch, only 13.7% of the respondents had used it regularly while15.1% of respondents had used it sometimes. About 26% of the respondents did not respond.

Finally, more than two-thirds of the respondents (71%) indicated that radios were not available and only 25% respondents indicated that they had radios at their schools. The fact that radios were available in few schools explains why few respondents had used them to enhance teaching and learning in their schools. The majority of the teachers surveyed (46%) rarely or never used a radio. Only 10% of the respondents used it regularly; 13 % of the respondents used it sometimes while 31.5% did not respond to the section. Although radios are inexpensive and educational programmes are aired on a daily basis, almost 46% of the teachers surveyed had rarely or never used them. The latter could suggest that most teachers had not embraced the concept of teaching with technology and its advantages to teaching and learning.

No other ICTs were mentioned by respondents besides those mentioned in the questionnaire. This high non-completion was despite the fact that respondents were asked to list other ICT equipment not already listed. Although 7.5% of respondents said they regularly used other ICT equipment, they did not name them. Another 7.5% had sometimes used them and 28% never or rarely used other unnamed ICT equipment. It is difficult to know what the “other ICT equipment” was or what they had been used for. Figure 9 summarises the respondents’ views on how the ICT equipment was being used in their schools.

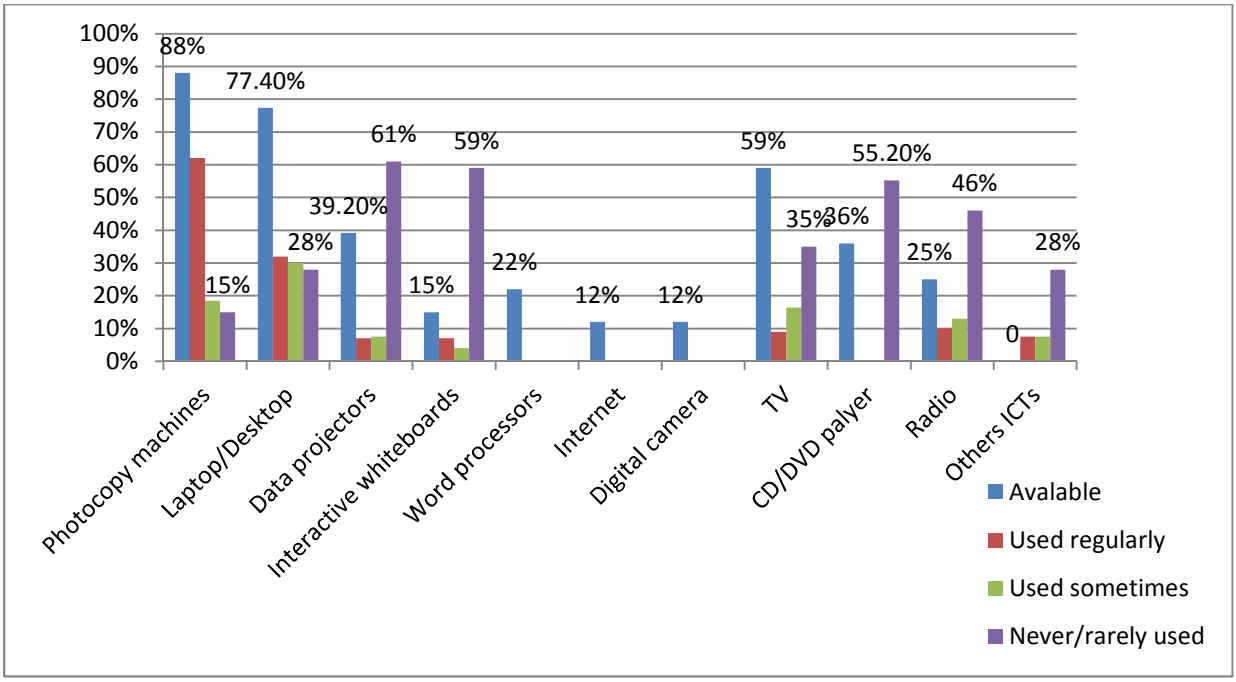

Figure 9: Usage of ICT equipment
Figure 9 created by the researcher

4.4.1 Summary

The findings in Figure 9 above reveal that many ICT resources, except for a TV, photocopier and laptop/desktop computer, are not available at schools for ICT integration. In some cases even the obligatory ones, such as a photocopier, are not available, so teaching and learning are compromised. It is difficult to comprehend how schools give tests and exams without them. Radios, interactive whiteboards and CD/DVDs are seldom used by teachers surveyed. This can be attributed to their unavailability. Findings on the availability of ICT resources reveal that the frequency of use and availability of ICT resources is proportional to each other. The ICT resources that are most frequently used are the ones that are available and those that teachers feel obliged to use in teaching, such as the photocopier.

4.5 MAJOR FACTORS PREVENTING TEACHERS FROM USING ICTS

On the basis of the findings above, the researcher wanted to find out what exactly were the major factors that prevent teachers from using ICT to improve teaching and learning. After the analysis of the responses from the respondents, it was clear that 59.6% of the respondents agreed or strongly agreed that lack of time contributes to educators' non-use of computers, while 41.8% of respondents agreed or strongly agreed that lack of knowledge is a critical

factor. The analysis of the results also shows that 34.2% of the respondents agreed and strongly agreed that lack of confidence prevents them from using computers. About 49.4% agreed that that lack of training was the main contributing factor to the lack or low usage of ICT in their schools. However, while only 11% of the respondents agreed or strongly agreed that age can negatively impact their implementation of ICT, the majority of respondents (74.4%) disagreed or strongly disagreed with the proposition that age is a factor that impedes educators from implementing ICT.

In addition, 38% of the respondents agreed or strongly agreed that there is no support from principal and SMT. As argued by Condie and Munro (2007:3), a critical factor in the effective use of ICT is the existence of a school-level e-strategy that addresses development and sustainability and includes some means of monitoring progress against identified milestones. While innovations often begin within a key stage or subject department, ICTs require a whole-school commitment if they are to become embedded in the daily experience of pupils, providing continuity and coherence across the years. While champions can, and often do, lead the way, new developments need leadership and strategic planning to ensure sustained changes in practice. As argued by Makewa, et al, 2013:50, "We are living in the information and technology age where school educators must possess computing capabilities. They must be users of technology and role models to those they lead." These authors also cite Yee (2000) who suggests that it is difficult to imagine a leader who does not use technology trying to convince teachers that it is important (Yee (2000) cited in Makewa et al, (2013:50). The fact that the majority of respondents said that they experienced a lack of support from their principals and the SMT is a cause for concern because teachers need to be supported and encouraged in using ICT in teaching by those in leadership positions. Lack of support from principals and SMT could also explain the low usage of ICT in the surveyed schools.

Furthermore, the researcher wanted to find out whether Internet affordability is a contributing factor to lack of or low usage of ICT in schools. The results indicated that 41.1% of the respondents agreed or strongly agreed that they could afford Internet. However, almost half of the respondents (48%) said they could not use Internet because they, as individuals and their schools could not afford it. Based on these findings, almost 50% of teachers surveyed saw Internet affordability as one of the major factors in their lack of use of ICT in teaching and learning at their schools. There is therefore a need for government to fasttrack the implementation of the "E- rate for public schools" as a matter of urgency to alleviate the

problem of Internet costs. E-rate is a government initiative that offers discounted rates for Internet connection for public schools as provided for in section 73 (1) of the Telecommunications Act, 103 of 1996. This stipulates that Internet connections must be provided at a minimum discounted rate of 50% off the total charge levied by the licensee which provides Internet services to such institutions. Sub-section (2) of section 73 of the same Act further states that such discount is applicable of the total charge levied by the licensee which includes but is not limited to:

> (a) "Any connectivity charges for access to the Internet; (b) charges for any equipment used for or in association with connectivity to the Internet; and (c) all calls made to an Internet Service Provider. In the case where the licensee, who provides Internet services to the institutions as contemplated in subsection (1), obtains its electronic communications facilities for the provision of Internet services from an electronic communications network service licensee, the licensee is entitled to a minimum of 50% off the retail rate charged to it by the electronic communications network service licensee for the facilities in question. (4) The implementation of this section must be in the manner prescribed. Furthermore, the Act provides that (5) The Minister may, in consultation with the Minister responsible for Education, declare categories of independent schools or private further education and training institutions to be entitled to the discount mentioned in subsection" (Telecommunications Act, 103 of 1996, section 1).

Finally, the researcher wanted to find out whether teachers do not use ICT in teaching and learning because there is no one else who uses it at the school. The analysis of the response shows that the majority of the respondents (77.4%) disagreed or strongly disagreed with the statement that no one else used computers at school. Therefore this cannot be a justification of why teachers do not use ICT to improve their teaching and learning. Only 9.6% of the respondents agreed or strongly agreed that they did not use ICT because no one else used the computer at their schools. The fact that the majority of respondents knew someone who used ICT at schools, but that few schools have ICT equipment, suggests that some individual teachers or principals are using their own resources to obtain ICT equipment. Figure 10 summarises the views of respondents on the perceived major factors that prevent teachers from using ICT equipment for teaching and learning purposes.

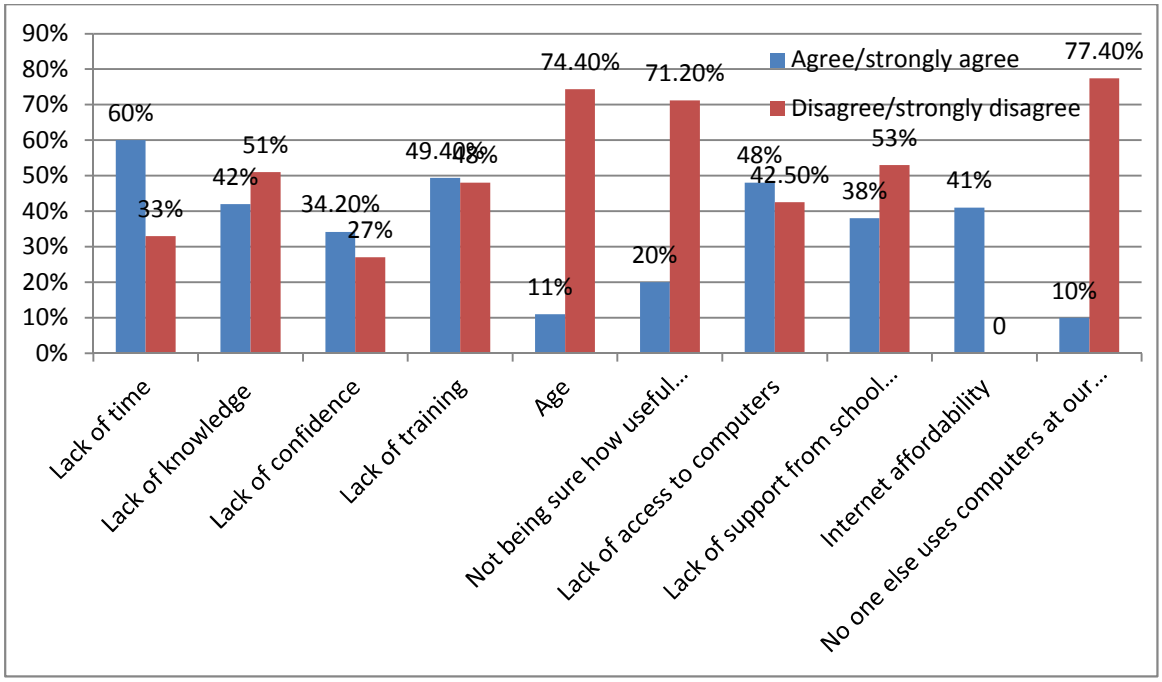

Figure 10: Major factors preventing teachers from using ICTs
Figure 10 created by the researcher

4.5.1 AVAILABILITY OF COMPUTERS AT PARTICIPATING SCHOOLS

It has been argued that ICT does not mean computers. However, computers tend to have a general usage in education and in teaching and learning (Stevenson, 1997:13). In addition, computers are most likely to be understood as comprising ICT in a rural area such as the Great Letaba Circuit. This is why the researcher wanted to find out the availability of computers in the participating high schools. The analysis of the results shows that 69% indicated that there are between zero and five computers at their school. About 7% indicated that there are six to ten computers whereas only 1.4% indicated there are fifteen to twenty computers. About 9% of the respondents indicated there are between 34 and 40 computers at their schools. The findings that there are schools that do not have even a single computer is disturbing. It is however, quite encouraging to note that there is a very small proportion of schools with many computers. The fact that some schools have computers does not necessary mean that these computers are used for improving teaching in schools. As the following paragraphs demonstrate, in many instances computers, which are available at high schools participating in this research, are mainly used for administrative purposes rather than for teaching and learning.

Table 9: Number of computers

Computers available at school	Percentage
0 – 5	69%
6 – 10	7%
15 – 20	1.4%
34 – 40	9%
No response	14%

Table 9 created by the researcher

4.5.1.1 Purpose for which computers are used in schools

The researcher wanted to find out the activities or functions for which computers are likely to be used at schools. The analysis of the results shows that the majority (86.3%) of the respondents used the computers which were available in their schools to perform administrative activities. This is both a positive and negative finding. It is positive because at least management is able to use ICT to do managerial activities such as keeping learner records, achievement, behaviour etc. However, if such a high rate of computers is used for administration, it leaves teachers with no computers for teaching and learning. In addition, 8.2% of the respondents said that computers are used for other purposes such as personal use. About 86.3%) of the respondents who indicated that computers are used for school administration corresponds well with 80.2% (72% plus 8.2%) of the teachers surveyed who indicated that computers are not used for teaching and learning. Among them are 24% who admitted having used computers which were available at the schools to play games (sometimes or regularly). Consequently some teachers still presented handwritten tests, assignments and projects to learners, even when there were some computers at school. Only 23% indicated that computers were used for teaching and learning. If the ICT which is available at school is used for purposes other than improving teaching and learning, it seriously jeopardises ICT integration. Figure 11 represents the views of respondents on the purpose for computer usage at their schools.

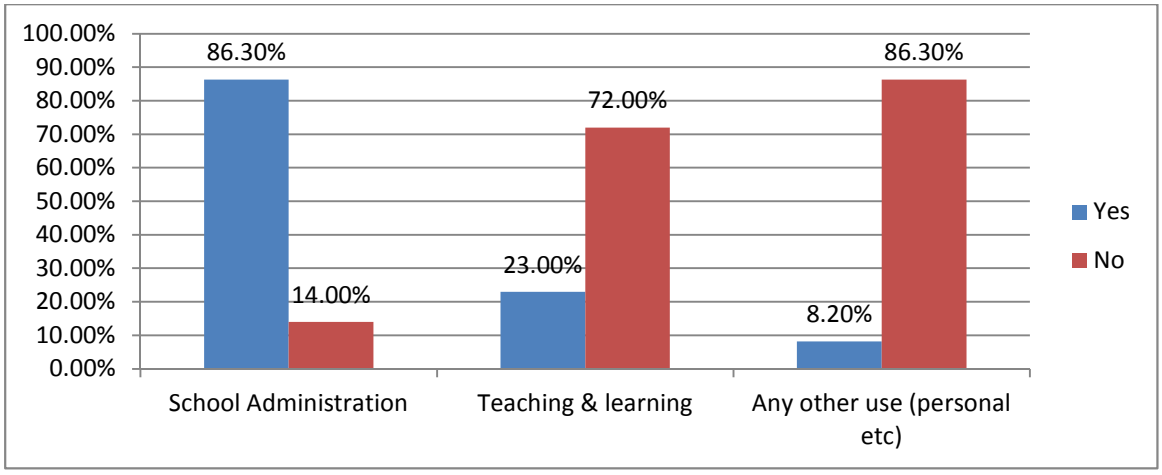

Figure 11: Purpose for use of computers usage at schools
Figure11 created by the researcher

4.5.1.2 Summary

The research findings above reveal that most of the schools surveyed have very few computers. This means that there were schools without a single computer. There were schools however that had between six and 40 computers. In the schools that have computers, including those that have many, the majority of these computers were used mainly for school administration or some other private purpose, not for teaching and learning. Although this enhanced the administration of schools, it left teachers with unacceptably few or no computers for teaching and learning, thereby compromising ICT integration.

4.6 FREQUENCY OF ICT USAGE FOR SELECTED PURPOSES

The above paragraphs show that the majority of high school computers were used to perform administrative work and that few had used ICT which was available in their schools to perform their teaching and learning functions. Some (11.0%) of the respondents said that they had rarely used a computer to prepare lessons, 19.2% used it regularly to prepare lessons while 18.5% used it sometimes to prepare lessons. This finding is disappointing considering the fact that the Department of Basic Education provides valuable information for teachers on the Thutong education portal to support teachers. Valuable information is readily available in discs and other formats.

Besides preparing lessons, however, at least 48% of respondents had used ICT to keep regular records. These included 24% of the respondents who had used it sometimes, and 6.2% who had rarely used ICT for record keeping. Record keeping may include records of

assessment, tracking learner progress, learner behaviour etc. This is commendable as it allows easy access to information and its proper safekeeping. Moreover, as one school principal who participated in this research noted: *Electronic records and data bases are easy to update, amend and transfer into many different formats".* About 16.4% of teachers surveyed had never used it for record keeping. The only concern, as this research has argued, is that ICT was often used more for administrative work and less for teaching and learning in schools.

The other use of computers which are available at schools is for schemes of work and lesson plans. The finding of this research shows that at least 14% of the respondents rarely used it for the same purpose, 21.2% of respondents used it sometimes and only 20.5% of the respondents used it regularly. Unfortunately, the majority of the respondents of 36.3% never used ICT for preparing their scheme of work or lesson planning. Furthermore, there is a evidence that some teachers used the ICT which is available at their schools to prepare lesson material. However, the information collected from the respondents shows that from a very low percentage (16.4%) of respondents, only one used ICT to access and to prepare lesson material regularly, about 34% of the respondents used it only sometimes and about 11% of the respondents rarely used ICT. However, although ICT and the Internet have a wealth of readymade material that can be utilised by teachers, it is disappointing to find that few educators have actually not regularly used ICT to access or to prepare lesson material but only to play games. The analysis of the data shows that 64.4% of respondents rarely or never played games using ICT – 15% of the respondents had sometimes played games and 9% had regularly played games using the school's ICT. This is both positive and negative. It is positive because teachers do not waste their teaching time playing games on school computers. It could however also be negative because teachers may not be playing game on school computers because they cannot use computers. Some games could be used for teaching and learning. Teachers who are not able to play games may not be able to effectively use ICTs for academic or pedagogic purposes. Figure 12 represent the respondents' views on the frequency of ICT usage in performing selected tasks/functions at the participating schools.

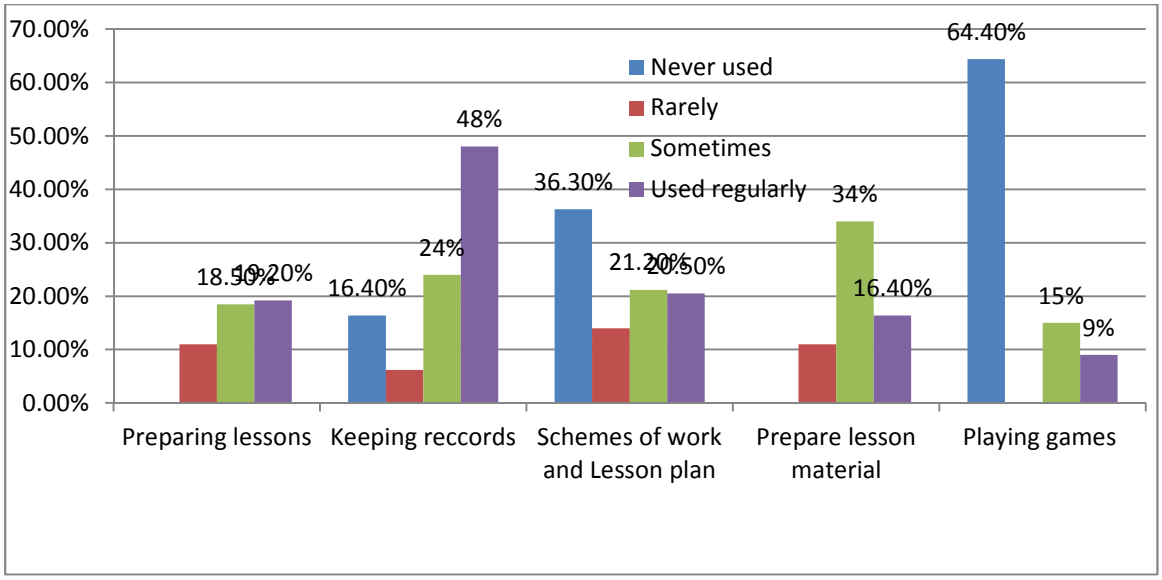

Figure 12: Purpose of usage of ICT equipment
Figure12 created by the researcher

4.6.1 Summary

The majority of teachers rarely or never use ICT to prepare lessons, their scheme of work or lesson planning. This is disappointing since the Internet and some sites provide affluent rich sources of prepared lesson material. Many teachers, nonetheless, use ICT to keep regular records. This is commendable. In conclusion, it is only a small fraction of teachers who regularly use ICT to play games. This is both a positive and a negative finding. It is positive because teachers do not spend valuable school time playing games on school computers. The non-use of computers to play games may also reveal an inability by teachers to use computers. Regular use of computers for games increases experience with computers or ICT and consequently teachers' confidence and readiness in ICT use.

4.7 MAJOR BARRIERS TO TEACHERS' READINESS AND CONFIDENCE IN USING ICT

The researcher asked respondents to list a number of major barriers to teachers' readiness and confidence to use ICT at schools.

It was surprising that only 17.1% of the respondents agreed that lack of ICT knowledge was a major barrier in their readiness and confidence in using ICT. In fact, the greater percentage (78%) said that lack of knowledge was not a barrier to their readiness and confidence in using

ICT. This is because, while many teachers said they did not have the skills to use computers to improve their teaching and learning, the educators said that they could learn how to use ICT and adapt to current technological advancement if these ICTs were available at their schools. It therefore appears that the educators blamed the absence or limited availability of the ICTs at schools for their lack of knowledge and confidence in using ICTs for teaching and learning. In fact, about 58% of the respondents said that the lack of training was not a major barrier to their readiness and confidence in using ICT because they would get the necessary training after getting the ICTs promised through the Department of Basic Education's TLI.

This claim is however not entirely true, because about 38% of these respondents also admitted that lack of training had been a major factor on their lack of readiness and confidence in using ICT. The claim also contradicts the fact that about 51.4% of respondents also agreed that lack of computers or the presence of very limited number of computers in their schools did not affects their readiness and confidence in using ICT. Such claim points to the possible lack of motivation (of largely older teachers as shown in the respondents' biographical information above) but possibly also to the illusion that getting ICTs would automatically be followed by the skills and confidence to use them, rather than lack of knowledge about the importance of using ICT in teaching and learning. This is because, as shown above, 55.1% of the respondents agreed or strongly agreed that ICT had an impact on their teaching. It is also because, while about 43.2% of the respondents claimed that lack or insufficient computers was the major barrier to their own readiness and confidence in using ICT; as many as 91% of the respondents rejected the proposition that: *"Not being sure of how useful computers are, is a barrier to readiness and confidence in using ICT"*. Only 3.4% of the respondents admitted to lack of knowledge about usefulness of ICT in teaching as to why they made no effort to improve their personal ICT skills.

It is therefore possible that some teachers at schools with ICTs may simply not use them in teaching and learning, not because they do not have the skills to do so, but because they do not see the importance of using them in teaching and learning. The attitude of such teachers could be linked to the lack of visionary leaders and support from school management team (SMT), as discussed previously. Almost 29% of the respondents agreed that lack of a school's ICT vision hampered their readiness and confidence in using ICT while 52.1% of the respondents indicated that there was no little or no support from their SMTs. The ICT

vision statement of the school spells out the direction the ICT initiatives have to take. The absence of such an important document frustrated the effort of almost 30% of teachers surveyed. This finding is disappointing. It is critical for the principal and SMT to provide all the necessary support for teachers in order to perform their duties well. It should be noted though that, at times, principals do not provide support not because they do not want to, but because they themselves know nothing about ICT and the importance of using ICT in teaching and learning. Other reported lack of support included lack of support from the national and provincial departments of education. More than a two-third percentage of 70.5% of the respondents indicated that there was no or little support from the departmental officials; with 39% of the respondents indicating that there was no or little support received from the family but, most importantly, lack of support from colleagues. About 49% of the respondents indicated that there is little or no support from colleagues and schools' ICT technicians. Timeous and on-going support from colleagues (and school management) is critical in order to motivate peers to also use ICT in their teaching and school administration work. The fact that the majority of the respondents (75.3%) indicated that there was little or no support from the ICT technicians at their schools is worrying because the availability and the willingness of technical support to help less ICT skilled teachers highly influences teachers' abilities and confidence to use ICT.

There is no convincing evidence to suggest that teachers' access to computers would automatically be followed by an increase in the skills and competencies to use them in teaching and learning. The literature has also shown, especially on the TLI discussion, that even teachers who got laptops did not receive sufficient training to equip them with the skills they need to use this computer to plan and deliver their teaching materials to the students. At the launch of the TLI, most teachers received basic training such as switching the computer on and off, basic use of email etc., but few received the necessary advanced training in ICT. As discussed in the literature review, while some ad hoc computer training for teachers has been provided by government, NGOs and private companies such as the Internet Service Providers' Association of SA's (ISPA), such training is often too short (lasting between one and ten days) to equip teachers with sufficient ICT skills to become proficient in using ICT to perform activities such as research, preparing and planning their lessons and delivering such lessons in the manner that benefits students (Kasonde, 2007:1). It is therefore very important to note that the knowledge to use ICT in teaching and learning is acquired through training and being in direct contact with ICT equipment, hence compulsory and continuing on-site

training must be implemented and ICT resources be made available to high school teachers. Such training should be long enough to equip the teachers with sufficient skills to be able to use ICT equipment for teaching and learning. Teachers also need to be-retrained regularly in order to keep up with ICT development. This objective could be achieved through *"in-service training"* (The New Times, 2013:1). The following Table 13 is a summary of the major barriers to teachers' readiness and confidence in using ICT in the schools that participated in this research. Figure 13 represents a summary of the level of ICT support received by teachers.

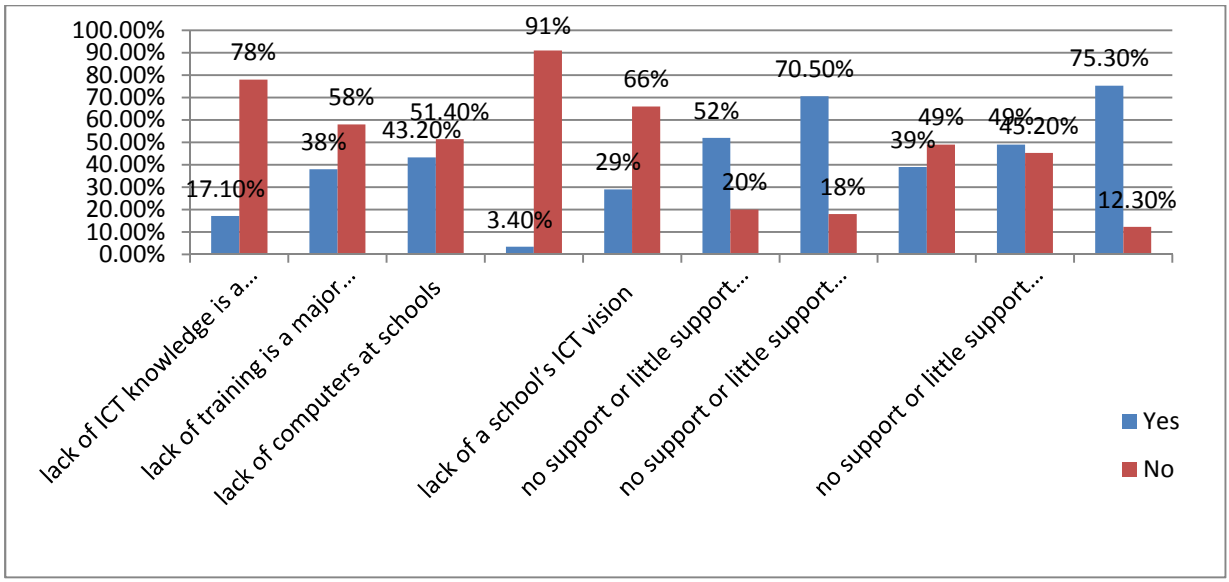

Figure 13: The level of support within the school
Source: Figure13 created by the researcher

4.7.1 Conclusion

The chapter focused on the findings of the research by discussing the implementation of ICT computers in schools. It started by looking at the availability of training in ICT, its effects on teaching and learning and the people responsible for financing the training. It also focused on the confidence of teachers to implement ICT in the classroom, given the training or the lack of it. The chapter went on to examine the use of computers by teachers at home and the experience this use or non-use has created. The next section concentrated on the major factors that prevent teachers from using ICTs and an examination of impact made by ICT in teaching. Additionally an analysis was made on the ICT equipment that is available at the different schools surveyed, the frequency of use of these ICTs by teachers for purposes such as preparing lessons, keeping records, preparing schemes of work and or lesson plans, lesson

material and playing games. In conclusion the chapter looked into the barriers that prevent teachers' readiness and confidence in using ICT and the support they receive within their schools in the implementation of ICT.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Chapter four discussed the findings and analysis of the data obtained through questionnaires. The purpose of Chapter 5 is to provide concluding remarks on the research problem stated in Section 1.3 (statement of the problem) of this study. Useful recommendations based on the data analysed in the previous chapter is provided, with the intention of assisting school management structures and the Department of Basic Education in South Africa to address the challenges that hinder the integration and usage of ICTS in teaching and learning in the schools that participated in this research. A summary of the preceding chapters of this research follows.

5.2 Summary of chapters

Chapter 1 presented the context of the study. The reason for undertaking the study was to analyse the effects of ICT on teachers' ability to perform their duties in terms of teaching and of managing other curriculum-related activities. In order to address this problem, a number of research questions were formulated and research objectives developed to assist in answering the research questions. The chapter includes the succinct definitions of key concepts relevant to the field of study, the data collection methods, ethical considerations, the significance of the study and an outline of the research chapters.

Chapter 2 presented a literature review, indicated what is available on the use of ICT in education in the existing literature and identified any gaps in the literature. The chapter started by analysing the literature dealing with the importance of using ICT in education and different types of information communication technology (ICTs), as well as the teaching and learning events associated with different forms of ICTs. This is because some types of ICTs are likely to have more impact than others when used alone or in conjunction with others to teach different subject areas. The literature review recognised that the term ICT applies to numerous types of electronic media; it also acknowledged that computers are likely to be understood as ICT in different contexts, especially in rural areas. Thus, the general use of computers and the Internet in teaching and learning was also explored in this chapter. The literature review also showed that the introduction of ICT in teaching and learning would inevitably lead to the paradigm shift in both the teachers' and students' roles and training and

competency requirements. This is the main suggestion in terms of "the constructivism paradigm" theory. Different suggestions on how to help teachers deal with the requirements of the constructivism paradigm theory were analysed. The chapter also discussed a number of common challenges/bottlenecks to the successful integration of ICT in schools and their proposed solutions. The chapter concluded by discussing some of the main challenges facing South Africa in terms of rolling out the ICT infrastructure to schools, especially those in rural areas where there is a more dire absence of ICT infrastructure than in urban areas. The chapter concluded with a discussion on some factors that were likely to lead to the failure of ICT integration.

Chapter 3 explained in detail the process involved in the sampling of the participants as well as the eliciting, capturing, analysing and interpreting of the data. Purposive sampling was used to sample the twelve schools. Data was collected using a questionnaire (see Annexure 12) and analysed using Statistical Packege for the Social Sciences (SPSS). The chapter concluded with an assessment of the data collected, indicating the flaws, shortcomings, gaps and limitations of the data.

The purpose of Chapter 3 was to describe and provide the rationale for the quantitative research design, the methodology used to collect data and the process for analysing the data. The purpose of the data collection, using questionnaires, was to assist in the understanding of the depth and extent of the problem of persistent lack of integration of ICTs in the teaching and learning in the twelve high schools in the Great Letaba Circuit in Limpopo which served as the sample of this research. The sampling method, the sample size and the reasons for the selection of respondents, as well as the quantitative data analysis methods, were also provided. The validity and reliability of the study were discussed, as well as its limitations and the ethical considerations.

Chapter 4 focused on the empirical research informed by the research methodology and data analysis described and discussed in Chapter 3. It started by looking at the availability of training in ICT, its effects on teaching and learning and the people responsible for financing the training. It also focused on the confidence of teachers to implement ICT in the classroom, given the training or the lack of it. The chapter went on to examine the use of computers by teachers at home and the experience this use or non-use has created. The next section concentrated on the major factors that prevent teachers from using ICTs and an examination of impact made by ICT in teaching. Additionally an analysis was made on the ICT equipment

that was available at the different schools surveyed, the frequency of use of these ICTs by teachers for purposes such as preparing lessons, keeping records, preparing schemes of work and or lesson plans, lesson material and playing games. In conclusion the chapter looked into the barriers that prevented teachers' readiness and confidence in using ICT and the support they received within their schools in the implementation of ICT.

Chapter 5 presented the research findings and a detailed analysis of the data collected in the course of the empirical research process as described in Chapter 4. The analysis was based on data collected through questionnaires, as discussed in Chapter4. The 146 participants from the twelve high schools of the Groot Letaba Circuit who constituted the sample for this research included both males and females of different ages and teaching work experience as described in, Chapters 1 and 3. This range of respondents helped to gather the vital information which was used in the analysis of this research. The remainder of this chapter presented a more detailed analysis of the data and the conclusions from this analysis, as well as certain recommendations arising out of these conclusions.

5.3 CONCLUSIONS BASED ON THE FINDINGS

The specific aim of the collection of the evidence was to analyse the effects of ICT on teachers' ability to perform their duties in terms of teaching and of managing other curriculum related activities in the Groot Letaba Circuit in Limpopo. After having carefully considered all evidence collected using the two data collection methods (i.e. literature review and structured questionnaire), the following conclusions are drawn, in line with the objectives of the research:

5.3.1 Presence of Information Communication Technologies (ICTs) in secondary schools in the Groot Letaba Circuit

The research findings paint a very disappointing picture with regard to the presence of ICTs in the twelve high schools of the Groot Letaba Circuit. A comparative analysis of different ICT resources shows that two types, namely the photocopiers (88%) and laptop/desktops computers (77.4%), are the only ones which appear to be available at many schools. However, while some computers are reportedly available at many schools that have participated in this research, the data projectors which are normally used in conjunction with computers have recorded a very low presence of only 39.2%. It is also troubling to observe that the majority (i.e. 84%) of all the teachers surveyed complained about the absence of the

Internet at their schools. It can be concluded that the few teachers who regularly use computers often use these computers as stand-alone gadgets and for administrative or personal use, rather than for teaching. Since most teachers do not have access to the computer and those who have access to computers generally lack access to the Internet, it can be reasonably concluded that few of them use computers for sharing education material or even for sending e-mails to each other. In addition, although a radio is generally affordable, about 71% of the teachers surveyed indicated that it is not available in their schools. Almost 60% of teachers surveyed also indicated that a CD/DVD player is not available at the schools and about 59% of the participants highlighted lack of access to TV sets in their schools. Lack of access to media such as TVs and radios in a rural area such as the Groot Letaba Circuit is a major setback to the learners, because they are not able to benefit from educational programmes that are often broadcast by the SABC radio and TV programmes.

This problem should be dealt with immediately by both the school management and the provincial and national Department of Education. Given the fact that the Groot Letaba Circuit is in a rural area without big businesses, government or the schools' management should seeking support from private partners such as NGOs (nationally or internationally) to solve this problem as soon as possible. Of the ten types of ICT resources**,** it is only the TV, photocopier and laptop/desktop computer which are said to be available to more than 50% of the respondents who participated in this research. The other seven types of ICT resources namely, radio, CD/DVD, digital camera, Internet, word processing, interactive whiteboard and data projector are said to be lacking in more than 50% of participating schools. One disturbing observation from the research result is that in some cases even the obligatory equipment, such as a photocopier, is not available at some schools. Any absence or shortage of ICTs which is reported here has the potential of compromising teaching and learning in the affected schools; corrective measures should be taken by the school management and the national and provincial Departments of Education. It is, quite difficult to comprehend how schools give duplicate tests and examination papers without photocopy machines.

5.3.2 The frequency of use of different types of ICT in teaching and learning

The analysis of the findings in the preceding chapter shows that where photocopiers happen to be available, they are most frequently used. At least 62% of the respondents reported to have used the photocopy machine regularly. Although radios are relatively inexpensive and

aired educational programmes are readily available on a daily basis, almost 50% of the teachers surveyed said they had never used them in their classrooms. A high percentage of the respondents surveyed (52.5%) indicated that TV is rarely or never used at school. The implication is that educational programmes offered by the SABC and other institutions to support learners are not accessible, so learners are missing out on valuable information in subjects such as Mathematics and Science. This research has already argued in Chapter 2 that many countries, such as Guinea, Togo, Djibouti, Tanzania and South Africa, are among those who use radio, television and print media more often than other technologies to provide supplementary curriculum content for teachers, including mathematics and science content and other subjects for learners (Farrell & Isaacs, 2009a:18). A lack of radio and TV sets in these schools also means that the students are not able to benefit from the many educational programmes produced by the Open Learning Systems Education Trust (OLSET), as discussed in Chapter 2. Teachers of these schools also miss out on much needed daily classroom support, which is accessible free of charge anywhere in South Africa, regardless of distance and geographical location. Lack of basic and relatively cheap ICTs such as radio and TVs in rural areas such as the Groot Letaba Circuit is a serious problem which should not be allowed to continue if the objective of transforming South African education and its provision to all South African learners, irrespective of where they live, is to be realised.

Furthermore, although 62% of teachers surveyed have said that they regularly or sometimes used a laptop or desktop computer, almost the same percentage (i.e. 61% of teachers) have never used a data projector to do their teaching work. The radio, interactive whiteboards and CD/DVDs are also seldom used by teachers surveyed. This can be attributed to their unavailability, except for computers which remain unused because of teachers' lack of necessary skills. The findings on the availability of ICT resources reveal that the frequency of use is directly proportional to the availability of ICT resources. That is, the ICT resources that are most frequently used are the ones that are available and those that teachers feel obliged to use in teaching, such as the photocopier. The photocopier may also be regularly used owing to its user friendliness, compared to some of the other ICT resources such as computers.

5.3.3 The effects/impact of the use or non-use of technology by teachers and principals on teaching and learning

This objective sought to investigate the impact the use of ICT has on teaching and learning. Findings from the study reveal that more than 55% respondents agreed or strongly agree that ICT has an impact on their teaching. The impact of any ICT equipment/resource is determined by both the availability and frequency of use of ICT resources, but also the willingness and confidence of teachers to use them. It then becomes paramount for schools and the Department of Education to find the means to provide ICT resources for schools for the integration of ICT into the curriculum. The need to devise a strategy to increase teachers' willingness and confidence to use them cannot be overemphasised.

5.3.4 The impact of ICT training on teachers' and principals' ability to use ICT

The finding on the impact of ICT training on teachers' and principals' ability to use ICT indicates that 59% of the respondents agreed that training received benefited them. However, about 41% of the respondents said they did not benefit from the ICT training they received, or said they were not sure of the benefits received from training. This finding is both positive and negative. It is positive in the sense that it indicates that the majority of the respondents who were trained on ICT derived benefit and were able to use them in their own teaching. The finding is, however, also negative in the sense that more than 40% of the teachers surveyed do not believe that ICT training has impacted their teaching. Reasons for the status quo may vary. Firstly, it may be that these teachers were trained a long time ago, as indicated in the findings in Chapter four, and so knowledge gained may now have become obsolete. Secondly, it may be that teachers are able to relate their ability to teach using ICT to the training they have received. Thirdly, and possibly in the worst case scenario, the quality of training they received may not have been adequate or, if adequate, then it was inadequately delivered to the recipients. In any of these scenarios the teachers would understandably not be able to positively identify the benefits from the ICT training they have received. Thus, although the finding is positive, this scenario is at the same time extremely disturbing. The other disturbing finding is that, of all the teachers that indicated that they have been trained, more than 70% of them (73%) paid for their own training. This is an indictment on the Department of Basic Education which claims to seek to use ICT to transform the education

and to avail good education to every South African child irrespective of where they stay in South Africa. If this status quo is allowed to continue, the integration of ICT in schools will be very slow. Noble projects such as TLI (discussed in different sections of this research) are also likely to fail if the Department of Basic Education does not prioritise teachers' ICT training.

5.3.5 Factors hindering teachers' readiness and confidence in using ICT

There are a number of factors that hinder teachers' readiness and confidence in using ICT. Teachers were surveyed on the following: lack of time (59.6%), lack of ICT knowledge (41.8%), inability to afford Internet (48%), lack of support from principal and SMT (38%), lack of confidence (34.2%), lack of training or lack of knowledge (41.8%), lack of schools' vision on ICT, insufficient number of computers (69% of schools have between zero and five computers), and not being sure of the usefulness of computers (3.4%). While it is encouraging to see that 91% of the respondents say that they know the usefulness of computers in teaching and learning and that age is not considered to be a limiting factor to the respondents, each one of these factors presents challenges to the integration of ICT in teaching and learning in high schools of the Groot Letaba Circuit. Therefore each one of these challenges needs to be dealt with accordingly. For example, although the teachers surveyed may be willing to integrate ICT into their teaching, their readiness and confidence are greatly hampered by the lack of sufficient computers and lack of appropriate training (including on-site training) to keep them updated with development in the technological sector. The Department of Basic Education which is responsible for high schools should use this state of affairs towards the mass rollout of ICT training to teachers, if the initiatives such as the TLI are to achieve their desired objectives of transforming South African education and bridging the gap between rural and urban areas. However, knowledge of ICT on its own does not guarantee ICT integration. It becomes valuable if it is decisively used for ICT integration. Therefore, if serious strides with regard to ICT integration are to be made, schools should have clear vision. ICT integration cannot be allowed to happen in a vacuum. There should be clear guidelines from management on how ICT should be integrated at schools so that teachers' efforts are shared.. Finally, it is encouraging to see that many teachers appear to know the usefulness of ICT in teaching and learning and of computers in particular, but often do not apply their knowledge. Teachers need to transcend theoretical knowledge to practical knowledge by learning the necessary skills they need to actually start integrating ICT in their day-to-day classroom and curriculum management activities. The following are some of the recommendations based on the interpretations of the findings and recommendations for further research.

5.4 Recommendations

One of the main objectives of this research is to recommend strategies that could be used to improve the use of ICT in teaching and of managing curriculum-related activities in secondary schools. ICT is seen as the tool that will be used to transform teaching and learning in the 21st century. However, for ICT to be fully integrated in the day-to-day teaching and learning activities and processes requires that the ways in which teachers teach, and the ways in which learners learn, has to change drastically. As highlighted in Chapter 1, providing ICT equipment and infrastructures to high schools in South Africa is hampered by lack of financial resources. Lack of finances and lack of ICT equipment and infrastructures are general problems affecting most, if not all, developing countries, including South Africa. Therefore, those schools which have some ICT equipment at their disposal should use it to improve teaching and learning. However, as this research has shown, this does not seem to be the case. As indicated in Chapter 1, this research was motivated by the researcher's observation of many principals and teachers in secondary schools where the researcher works, who are supplied with state-of-the-art ICT with the purpose of improving their performance both in management and in the classroom; yet they often fail to make use of this ICT equipment to improve teaching and learning and the management in their schools. About 86.3% of the respondents who indicated they use computers for school administration and well over 80.2% (72% plus 8.2%) of the teachers surveyed indicated that computers available to their schools are not used for teaching and learning.

A number of factors, including lack of sufficient ICT equipment, lack of school management support, lack or inadequate training of teachers who are expected to use these ICTs to improve teaching and learning, are but a few identified in Chapter 4 as being the reasons behind this low usage of ICT to improve teaching and learning in schools that have participated in this research. A drastic change of teachers and learners skills and attitude is needed. There is not a single solution to these problems. The following are some of the recommandations that could be implemented in an attempt to increase the use of ICT in teaching and learning in the participating schools, and possibly the whole province and the whole of South Africa.

- School managers and the Department of Basic Education should continuously evaluate the impact of ICT on teaching; then develop programmes to assist struggling teachers and reward well-performing teachers by offering incentives. The

findings of such evaluation could be used to design appropriate and deliberate intensive training programmes to address identified weaknesses.

- Schools and the department should make a credible audit of the ICT resources available at schools and ICT skills of teachers already in the employ of the department, in order to develop a well-informed comprehensive intervention strategy.

- Where resources such as TV and radio are available, teachers must be encouraged to use them. TV and radio offer live broadcasts of educational programmes on a daily basis during weekdays and are relatively cheap and user-friendly. Rural schools which still have the challenges of accessing electricity should take advantage of radio regularly, while schools which have access to electricity should be encouraged to use TV and other ICT equipment regularly to support learning.

In order to deal with the problem of digital divide between the poor and the rich and between rural and urban areas, the Department of Basic Education should ensure that all schools have access to ICTs. Whenever possible, the Department of Basic Education, school principals' School Management Team (SMT) and School Governing Bodies should make an effort to secure additional funding from Non-Governmental Organisations (NGOs) and the private sector to procure ICT resources for schools which do not have them, or to augment available ICT resources. As indicated in Chapter 2 of this research, the Public-Private-Partnerships (PPP) have been and remain a sensible answer to the budget constraints that face public education (Flor, 2008:13). Examples of where NGOs and private business companies such as IBM have donated computer equipment to schools or have provided ICT training to teachers have been given in Chapter 2 of this research. The challenge that ICT training seemed to be ad-hoc and of short duration, with a general focus on providing limited basic ICT skills, was also highlighted in this research. There is therefore a need for a comprehensive nation-wide training of high school teachers if ICT is going to be used as a means of transforming education in South Africa.

- Where there are enough resources such as computers, they must be made accessible to teachers by being placed in localities which guarantee easy access and safety. However, the fact that 40% of teachers who participated in this research seem not to be convinced that use of ICT equipment will improve their teaching or their students' learning is a serious concern. There is therefore a need for a campaign to raise the awareness of the importance of ICT in teaching and learning.

- Principals and School Management Teams should provide discernible encouragement to their staff to enable them to teach, using ICT effectively. Whenever possible, the management team needs to model good and acceptable practice for teachers to emulate. However, the use of ICT should not be left to teachers and school management teams only. There is a need for political will in order to achieve ICT integration in teaching and learning in South Africa. Such political will is necessary in order to establish proper policies in terms of ICT use and ICT funding, but also to follow through to implement these policies and provide budgets for the acquisition of ICT tools and for sustainability. Both Chapter 2 and 4 of this research have already highlighted the fact that schools are not only faced with the problem of shortage or total lack of ICT equipment, but also with the problem of high costs of maintaining the equipment and basic needs such as access to the Internet. Government, as the custodian of the education of the nation's children, should take the responsibility to pay for everything (ICT equipment, maintenance and any costs incurred in the provision of education) – not the teachers themselves.

- However, government efforts need to be supported by school management teams (such as school principals) who understand the value and importance of integrating ICT in teaching and learning in their schools. Therefore, the school management teams should not only focus on outsourcing expert knowledge on ICT to bolster teachers' ICT knowledge through mentoring and support, but also leading by example. They can be role models to teachers by being the first to get appropriate ICT skills, by using ICT consistently in their day-to-day management functions and by encouraging teachers in their schools to do the same. As highlighted in Chapter 2 of this research, it is difficult to imagine a leader who does know how to use ICT or does not use it in their work, but tries to convince his/her subordinates that it is important (Yee, 2000, cited in Makewa, et al, 2013:50).

The above analysis shows the inevitability of paradigm shift, not only in terms of teaching and learning but also in terms of the student/teachers ICT skills. Therefore, the Department of Basic Education should provide pre-service and ongoing in-service training for teachers on how to use ICT for teaching. The Department of Education should set up refresher courses on how to use computers, since the majority of teachers were trained more than five years ago. It should also provide compulsory training for principals and SMT staff members so that they can assume their leadership role of ICT integration in schools. “For the effectiveness of ICT integration, administrators must be competent and have a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education” Mikre (2011:14). Moreover the department should also always keep track of the rationale and effectiveness of teacher training. Compulsory on-site ICT training programmes are vital if ICT integration is to succeed because, as Chapter 4 of this research has shown, the majority (67.3%) of respondents are older than 40 years and over 76% of respondents who claim to have received any ICT training received it more than one year ago. This suggests that they have not kept up-to-date with new development in the ICT sector. While this research does not claim that this age range represents the whole of the Limpopo province or the country, the fact that most teachers in the participating schools of the Groot Letaba Circuit seem to be older than 40 suggests the need for aggressive ICT teaching initiatives.

In addition, there is also a need for the Department of Basic education to set its ICT initiative priorities correctly. For example, proper and comprehensive ICT training programmes which are compulsory to all teachers should have preceded government initiatives such as the Teacher Laptop Initiative discussed in Chapter 2 of this research. Such training should be comprehensive enough to allow teachers to acquire the necessary ICT skills. Furthermore, while the provision of laptops to teachers in a major step to minimise the rural-urban areas divide, it seems that government is forgetting that laptops need external hardware such as data projectors. Unfortunately, while the data projectors are normally used in conjunction with computers, this research has recorded a very low presence of them in the sense that only 39.2% of participating schools have data projectors (see Chapter 4 of this research). In addition, there is a need to avail enough computers to schools in order for students to learn to use them. It is impossible to imagine how the objective of achieving a: “more learner-centred and interactive methods, whereby the teacher takes more of a facilitator role and moving away from the direct instructional” *(*Knapper, 2001:94) (the basis for the constructivism approach discussed in Chapter 2 above), is possible if students have no access to computers.

Therefore, the Department of Basic Education, as a custodian of education, should find appropriate ways to offer timeous and continuous general ICT and quality technical support to teachers in schools through district and circuit offices. Availability and usage of computers have the potential of enhancing teachers' and students' confidence and, ultimately, ICT integration. Therefore, the Department of Basic Education should fast-track the acquisition of laptops through the Teacher Laptop Initiative for teachers. There is also a need to provide school managers with at least one computer for administration, but many more computers are necessary in order to increase access for students. Whenever possible it should be made compulsory for every teacher and student to have a laptop or smartphone. However, both the computers and smartphones require that government fast-tracks the implementation of the e-rate for schools to offer discounted fees for Internet connection for public schools as a matter of urgency in order to deal with the challenges of Internet costs.

5.5 Recommendation for further research

As in any study, there are constraints encountered that limit the research, whether inherent in the research design or superficially determined. These limitations are important for they provide the foundation for future research. This study was carried out within one circuit of the Mopani District in the Limpopo Province. Similar studies could be carried out in other circuits of the district in the province and in the country as a whole in order whether other secondary schools in the district and province face similar or entirely different issues in relation to ICT integration. Finally, further studies also could evaluate the ICT training received by teachers in order to determine its effectiveness and efficiency.

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ANNEXURE A: LETTER OF CONSENT

01 June 2014

Dear colleagues

I am presently conducting a study on the "the utilisation of ICT in schools" at the Department of Education as part of the requirements to obtain a Masters Degree in Public Administration at the University of Limpopo. Information Communication Technologies (ICTs) consist of the hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images), as well as related services. These technologies range in turn from conventional gadgets e.g. videos, audio tapes, radios, television, to modern state of the art technologies, such as computers and SMARTPHONES.

I regard this research as critical to the understanding of ICTs and their effect on teaching and learning in the Department of Education in the Groot Letaba circuit. Your opinion is thus highly valued. I have enclosed a questionnaire for your completion. It has been designed to make completion as fast and easy as possible and should not take more than 30 minutes to complete.

You are asked not to write names on the questionnaires so that it would not be possible to link any of you with your responses.

Looking forward to receiving your response

Yours Faithfully

Mr Mlunghisi Derick Mathevula

ANNEXURE B: QUESTIONNAIRE ON ICT UTILISATION

ICT USAGE AT SECONDARY SCHOOLS

HOW TO COMPLETE THIS QUESTIONNAIRE

This questionnaire is designed to make completion as easy and as fast as possible.

Most questions can be answered by simply ticking boxes. Very little information will need to be looked up. If you cannot give or obtain a precise answer, make your best guess or approximation.

As the anonymity of all respondents will be strictly observed, **DO NOT** write your name on the questionnaire. Without names, it will not be possible to link answers to particular individuals.

Should you be of the opinion that additional comment is necessary, please use the space provided at the end of the questionnaire.

If you have any queries, please contact the researcher at:

Mr. MD Mathevula, PO Box 1227, Lulekani 1392.
Tel. 015 7830 533 / Cell. 082735 0936
E-mail: mdmlunghisi@gmail.com

Please return the completed questionnaire to the sender
No later than 30 JUNE 2013

SECTION A: BIOGRAPHICAL INFORMATION

A1. Gender:

Male	1
Female	2

A2. Age

21 to 30 years	1
31 to 40 years	2
41 to 40 years	3
51 to 60 years	4
Older than 60 years	5

A3. Teaching experience

Less than 1 year	1
2 – 5 years	2
6 – 10 years	3
11 – 15 years	4
15+ years	5

A4. Main Subject taught: _____

A5. Highest academic qualification

Diploma (3 years)	1
B. degree	2
Honours degree	3
Doctoral degree	4
OTHER (Please specify)	5

A6. Please indicate your current job level in the department of education:

Principal	1
Deputy principal	2
HOD	3
CS1 teacher	4

A7. Do you have any professional ICT qualifications?

Yes	1
No	2

If yes please give details _____

SECTION B: ICT UTILISATION

B1. What type of computer training, if any, have you had?

1. None at all	1
2. Basic computer literacy (on/off, loading software)	2
3. Applications (e.g. ECDL)	3
4. ICT integration (using computer to teach in class)	4

Other (Please state) _____

B2. Why did you undertake this training? (Tick all that apply)

Required to do it	1
Increase career prospects	2
Personal interest	3
To use ICT in class	4

B3. Number of years since you last had ICT training of any kind _____

B4. Do you think that the training you had has provided you with the skills you need to be able to use ICT in your teaching?

Yes	1
No	2

B5. Who was responsible for financing the computer training you ever had?

Self-financed	1
Paid for by school	2
Paid by a donor	3
Paid by Department of Education	4

B.6. Rate your level of confidence in implementing ICTs in the classroom.

No confidence	1
Little confidence	2
High confidence	3
Some confidence	4
Unsure	5

B7. Do you use a computer at home?

Never	1
Rarely	2
Occasionally	3
Frequently	4
Always	5

B8. How would you rate your experience with computers? (Tick all that apply)

Excellent	1
Good	2

Fair/moderate	3
Poor	4

B9. The following are major factors that prevent you from using or not using ICTs? Please indicate the extent to which you agree/disagree by ticking the appropriate box.

Factors that hinders ICT use	Strongly disagree	Disagree	Agree	Strongly agree	Don't know
Lack of time to use computers	1	2	3	4	5
Lack of knowledge about computers	1	2	3	4	5
Lack of confidence	1	2	3	4	5
Lack of training	1	2	3	4	5
My age	1	2	3	4	5
Not sure how useful computers are	1	2	3	4	5
Computers not accessible	1	2	3	4	5
No support	1	2	3	4	5
Cannot afford Internet	1	2	3	4	5

B10. Has ICT had an impact on your teaching?

Strongly Disagree	1
Disagree	2
Agree	3
Strongly agree	4
Not sure	5

B11. What are the ICT equipment that are available at your school? PLEASE TICK

Photocopier	1
Laptop/Desktop Computer	2
Data Projector	3
Interactive Whiteboard	4
Word Processing	5
Internet	6
Digital Camera	7
TV	8
CD/DVD player	9
Radio	10

Please list the ICTs that are available but not listed above.

_____

_____

B12. How many computers are there in your school? _____

B13. If computers are available, what are they mainly used for? Tick the relevant one

Administration	

Teaching and learning	
Any other use (personal etc.)	

B14. If computers are used how many are used for the following?

Administration	
Teaching and learning	

B15. How often do you use the available ICT equipment? PLEASE TICK

Equipment	Regularly	Sometimes	Rarely	Never
Photocopier	1	2	3	4
Laptop/desktop computer	1	2	3	4
Data projector	1	2	3	4
Interactive whiteboard	1	2	3	4
Digital camera	1	2	3	4
TV	1	2	3	4
CD/DVD player	1	2	3	4
Radio	1	2	3	4
Others	1	2	3	4

B16. How often do you use these ICTs for the following purposes?

Purpose	Regularly	Sometimes	Rarely	Never
Preparing lessons	1	2	3	4
Keeping Records	1	2	3	4
Schemes of Work and/or lesson Plans	1	2	3	4
Lesson Material	1	2	3	4
Playing games	1	2	3	4

B17. What do you see as the major barriers to your readiness and confidence in using ICT?

Lack of ICT knowledge	1
Lack of training	2
Lack of school's vision on ICT	3
Insufficient number of computers	4
Not sure how useful computers are	5

B18. Rate the level of support within your school with regard to ICT use

Supporter	No support	Little support	Good support	Excellent
Principal (SMT)	1	2	3	4
Family	1	2	3	4
Colleagues	1	2	3	4
Departmental officials	1	2	3	4
ICT technicians	1	2	3	4

SECTION C: GENERAL COMMENTS

If you have any additional comments please write them in the space below:

_____
_____
_____
_____
_____
_____
_____

Thank you for your time and valuable contribution to this important survey

ANNEXURE C: LETTER OF REQUEST TO CONDUCT RESEARCH

Enquiries: MD Mathevula
Cell no: 082 735 0963
Home Tel no: 015 7830 533
Email address: mdmlunghisi@gmail.com

P.O. Box 1227
Lulekani
1392
29 March 2013

The Head of Department
Limpopo Provincial Department of Education
Private Bag x 9489
Polokwane
0700

Sir/Madam

Request for permission to conduct research: ICT utilisation in secondary schools

1. The above has reference
2. I am a masters student with the University of the North (Turfloop Graduate School of Leadership (TGSL) campus)
3. As part of the masters' programme I have to write a mini dissertation
4. My research topic is " *The effects of ICT on secondary schools teachers' ability to perform teaching and management of curriculum related activities: A case of Groot Letaba Circuit, Mopani District in the Limpopo Province, South Africa"*
5. I therefore would like to request your permission to conduct research in all Groot Letaba Secondary Schools
6. The research is scheduled to commence from the 1st to 30 of June 2013 and shall in no way affect the day to day activities of the schools
7. All data collected shall be anonymised and treated in the strictest confidence and no individual or school will be identifiable in the published report
8. Thanking you in anticipation

Yours faithfully

Mathevula MD (Mr)

ANNEXURE D: PERMISSION TO CONDUCT RESEARCH- PROVINCIAL DEPARTMENT OF EDUCATION

Ref: 81065728
Enq:Masuluke T.M
Tel: 015 8117797
Date: 2013.05.14

The Head of Department
Dept. of Education Limpopo
Private Bag x 9489
POLOKWANE
0700

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN GROOT LETABA SCHOOLS: MATHEBULA M.D

1. The above matter bears reference.

2. Mr Mathebula M.D is a CS1 educator of Magulasavi High School under Groot Letaba Circuit. He has submitted a letter requesting approval to conduct research in schools under Groot Letaba Circuit to complete his Masters' degree with the University of Limpopo. The research shall focus on the effect of the utilisation of ICT by teachers and the principals on teaching and learning. The research will commence on the 01.06. 2013 to 30.06.2013.

3. Attached herewith please find Mr Mathebula M.D's application letter.

4. This office recommends that Mr Mathebula M.D be granted permission to conduct research as per his application.

5. Submitted for your approval and further directives.

DISTRICT SENIOR MANAGER