Teachers' experience of Information and Communication Technology use for Teaching and Learning in Urban Schools

by

SHIRLEY SYMPATHONIA MUKHARI

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Supervisor: Professor G van den Berg

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DECLARATION

Student number: 420830-7

I declare that: **Teachers' experience of Information and Communication Technology use in teaching and learning in urban schools** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

SIGNATURE   DATE

DEDICATION

In memory of my husband

Mathukuthela Isaac Mukhari

Dedicated to my children

Nyiko and Wisani

For being the light and the joy of my life

ABSTRACT

The use of Information and Communication Technology (ICT) in teaching and learning is of significant importance to a country's development and the social growth of individuals. As a result, ICT usage is gaining momentum in world schooling systems. Cognisant of the benefits of ICTs in teaching and learning, South African schools have introduced ICTs in schools and teachers are compelled to adopt and integrate technology to improve their pedagogic activities. The purpose of this research was to explore South African teachers' experience in using ICT in the schooling system. This study was underpinned by the Network Society theoretical framework that endorses the use of ICTs in teaching and learning environments. The research method used in the study followed a qualitative interpretative approach and data collection methods included a literature study, non-participant observation and semi-structured interviews with a purposefully selected sample of teachers and school principals and analysis of documents on ICTs in teaching and learning. Findings indicated that ICT integration in teaching and learning is endorsed by teachers and principals who understand the benefits of ICT in enabling better methodological strategies, greater collaboration among teachers, improved access to the required information and the ability to cater for learners with different potential and learning styles. However, a number of factors that hinder the successful ICT integration in urban schools were identified as inadequate ICT infrastructure, teachers' lack of ICT skills and low level of ICT proficiency, inadequate training, negative attitudes and poor teacher confidence. Other factors included lack of ICT leadership, funds and technical support. These findings indicated poor implementation of policy and a lack of connection between theory and practice. It was concluded that all education stakeholders, including parents, should work together in securing an ICT infrastructure that will accommodate all learners. It was recommended that more regular workshops which focus on the development of ICT skills in accordance with the proficiency levels required to effect successful integration of ICTs by teachers, be conducted. Moreover, principals should attend training workshops to learn about their responsibilities as ICT leaders at school. Technological pedagogical and content knowledge (PACK) together with CRAR3FS2 principles could provide a crucial framework for training South African teachers to overcome their ICT skill challenges. The ultimate goal of this study is to analyse factors that both hinder and enable the integration of ICTs into teaching practice in South Africa and to contribute to the body of literature on ICT integration in South African urban schools.

KEY TERMS

Teachers' experience

Information and Communication Technology

ICT usage

Teaching

Learning

Urban schools

Network Society theory

Learning theories

Qualitative research

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LIST OF ACRONYMS

3Rs	Reading, Writing and Arithmetic
AACTE	America Association for Colleges for Teacher Education
ACE	Advanced Certificate in Education
BEd	Bachelor of Education
BTech	Bachelor of Technology
CAI	Computer-Aided Instruction
CAPS	Curriculum and Assessment Policy Statement
CaT	Curriculum and Technology
CK	Content Knowledge
CMC	Computer-mediated Communication
CoL	Community of Learning
CRAR3FS2	Care, Relate, Assess, Reflect, Read, Re-Plan Feedback, Share and Support.
CSIR	Centre for Scientific and Industrial Research
DBE	Department of Basic Education
EACEA	Education, Audiovisual and Culture Executive Agency
ELearning	Electronic learning
FET	Further Education and Training
GDE	Gauteng department of Education
GET	General Education and Training
GoL	Gauteng online
GPMLS	Gauteng Primary Mathematics and Literacy Strategy
HOD	Head of Department
HSRC	Human Science Research Council
IBM	International Business Machines
ICT	Information and Communication Technology
ICT4AD	Information Communication Technology for Accelerated Development
MEC	Member of the Executive Council
M-Learning	Mobile Learning
MoE	Ministry of Education
NAPTOSA	National Professional Teachers' Organisation of South Africa
NDP	National Development Plan

NECT	National Education Collaboration Trust
NSES	National School Effectiveness Study
OBE	Outcomes-Based Education
OLPC	One Laptop Per Child
PCK	Pedagogical Content Knowledge
PDE	Provincial department of Education
PIRLS	Progress in the International Reading Literacy Study
PK	Pedagogical Knowledge
RNCS	Revised National Curriculum Statement
SADTU	South African Democratic Teachers Union
SGB	School Governing Body
SMT	School management Team
STEPS	Study of the impact of technology in Primary Schools
TC	Technological Knowledge
TCK	Technological Content Knowledge
TIMSS	Trends in International Mathematics and Science Study
TPACK	Technological Pedagogical Content Knowledge
TPK	Technological Pedagogical Knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organization
Unisa	University of South Africa
ZPD	Zone of Proximal Development

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CHAPTER 1

INTRODUCTION AND OVERVIEW

1.1   INTRODUCTION

This study is about a very sensitive and topical issue, the use of Information and Communication Technologies (ICTs) in teaching and learning in the schooling system, with specific reference to Gauteng Province, South Africa. In developed and developing countries ICTs are hailed as a panacea to the challenges encountered in education systems and are also regarded as tools that have the potential to transform education by enhancing the quality of teaching and learning. Consequently, many urban schools in South Africa and especially in Gauteng Province are resourced with an ICT infrastructure to improve the quality of teaching and learning. This study discusses ICT in the education policy of the Department of Basic Education (DBE, 2004) and Gauteng Department of Education (GDE, 2007) in South Africa as a cornerstone for the introduction of ICTs in the schooling system. Their ICT policy emphasises ICT use as a means to enhance the quality of education for social and economic growth and ensure the establishment of the knowledge society (DBE, 2004:10).

The aspects that are presented in this chapter are: background information to the study, theoretical frameworks, problem statement, the research questions, study aims, significance of the study, the research methodology, ethical considerations, clarification of terms, an overview of the study and conclusion.

1.2   BACKGROUND INFORMATION TO THE STUDY

At the dawn of the 21st century, the prevalence of ICTs in all aspects of life and the need for the establishment of the knowledge society led many countries such as the United Kingdom (UK) (Livingstone, 2012:2), Malaysia (Kannan, Sharma and Abdullah, 2012:111), Turkey (Cavas, Cavas, Karaoglan and Kisla, 2009:200) and the Republic of Korea (Hwang, Yang and Kim, 2010:21) to introduce and expand the use of ICTs in their education systems to transform education and to establish knowledge societies. Gauteng Province in the Republic

of South Africa also introduced ICTs to educate and train its citizens to compete with the populations of other countries which are described as knowledge societies. To do so Gauteng had to improve its education system by introducing ICTs in all its provincial schools. The other reason for ICT integration was to alleviate and mediate the challenges experienced in the education fraternity regarding the mastery of technology and the increasing flow of information. The Tshwane North schools in Gauteng are equipped with ICTs to enhance teaching and learning activities, thereby preparing the learners for the future. Some teachers in these schools have received training in the use of ICTs, but a number of schools are not using ICTs in an effective way. The study focused on teachers' experience on ICT use in ten Mamelodi primary and high schools which fall under Tshwane North District of Gauteng Province, South Africa. The selected schools have ICT infrastructure for teaching and learning and they are in partnership with certain independent schools in Pretoria. Finally, the researcher resides in the Mamelodi area and the selected schools are thus within easy travelling distance.

The reconstruction of the systems of education was based on the belief that ICTs have the potential to enhance and expedite teaching and learning, thus improving educational skills across the school curriculum (Livingstone, 2012:3). As a result of the spread and the infiltration of ICTs, many countries worldwide developed national policies that endorse the use of ICT in education as a means of offering new ways in which quality, effectiveness and efficiency can be improved in teaching and learning fraternities. Thus, the use of computers and other related technologies, such as the internet in schools by teachers and learners, has become a priority for educational and social reasons.

Computer technology therefore, became an important part of education in order to bring about new ways of teaching and prepare learners for their future in an information age (Papaioannou and Charalambous, 2011:350; Bingimlas, 2009:235). Education systems in some underdeveloped countries also embraced ICTs in education in order to overcome their educational shortcomings and develop the 21st century competencies which include critical thinking skills, problem solving skills, inclusivity, life-long learning, global interaction, collaborative teamwork, and cooperative learning (AACTE, 2010:9; DBE, 2004:16). Tire and Mlitwa (2008:142) maintain that the benefit of ICT use is not restricted to the classroom

environment but orientates and introduces learners to ICT practices in the post-school technology-based information economy. Consequently, the Gauteng Department of Education (GDE) established ICT laboratories with internet connections to provide ICT access for all teachers and learners in order to realise and experience the opportunities of ICTs in improving learners' performance. In 2014 through the eLearning Solution project, Gauteng public schools were provided with 40 tablet computers per school to provide learners with the opportunity to access learning material digitally, and to create a teaching culture that incorporates eLearning as a tool for enhancing both teaching and learning (Makhura, 2015:15; GDE, 2007:18). In addition to ICT for teaching and learning, the provision of tablets is consistent with the Gauteng government's vision and mission of building a smart, knowledge-based and innovation-driven economy in the province (Makhura, 2015:15).

South Africa recognises ICT as the building block of its society and the critical role of ICTs in enhancing the schooling system. As a result, post-1994 the Department of Basic Education (DBE) and the GDE stress the importance of integrating ICTs in teaching and learning in order to redress a historical inequity. The dismal performance of South African learners in the 2011 Third International Mathematics and Science Study (TIMMS) tests (HSRC, 2012:4) and the need to improve the quality of education and create new and innovative models of teaching are some of the factors which necessitated the inclusion of ICTs in teaching and learning. These new methods also maximise learning opportunities and prepare learners for future jobs in an information age (Sipilä, 2014:225). Therefore, the realisation of educational innovation through ICT integration in teaching and learning depends on teachers' ICT proficiency in the effective use of ICTs as indicated by Bladergroen, Chigona, Bytheway, Cox, Dumas and van Zyl (2012:107). The government also states it is imperative that all teachers embrace and adopt ICTs and use them in their teaching to ensure learners with different potential and learning styles benefit from ICTs.

Despite the efforts by national and provincial education departments to provide the basic ICT infrastructure, the integration of ICTs in schools seems not to have been implemented according to the policy initiatives. Bladergroen *et al.*, (2012:115) refer to the availability of technology for use in schools and its unsuccessful integration in teaching and learning. Their research findings (Bladergroen *et al.*, 2012:116) indicate that teachers are enthusiastic

about the integration of ICTs into their practices. However, in reality, many teachers appear to resent using ICTs for teaching and learning. Van Wyk (2014:4) states that most ICT capacity in schools is either under-utilised or not used at all. Ford and Botha (2014:4) concur with this finding, stating that only 2% of computer laboratories in well-resourced South African public schools are actively used. These assertions indicate that there is a gap between the well-developed ICT in education policy and its implementation in schools due to factors that are particular to the school environments.

1.3   THEORETICAL FRAMEWORK

Behaviourism, constructivism and connectivism are learning theories that endorse the use of ICTs in an educational environment depending on the teacher's pedagogy, the subject matter and educational goals as well as the potential of learners that are taught. Although these learning theories differ in their perspectives, they are not mutually exclusive and as such complement each other. These three theories are still relevant in the schooling system to enable teachers to achieve their aims.

The theoretical framework underpinning the study is network society theory which emphasises the significant role played by the new technologies of information and communication and the formation of connections for the creation and distribution of knowledge in the network society. Cavas *et al.*, (2009:20), Castells (2007:246) and Siemens (2004:4) maintain that participants in the network society use communication, computer networks and the internet to create and acquire, share and disseminate information in order to become knowledgeable and better human beings and to make the world they live in a better place.

The use of ICTs in the network society is also important to induce the culture of virtual reality which stimulates creative thinking by allowing problem solution in ways not usually possible. In a pedagogical situation, virtual reality technologies are used in authentic learning where learners experience phenomena that are impossible to explore in the traditional classroom. This theoretical framework requires teachers to use ICTs in their

teaching tasks in order to produce learners equipped with 21st century skills that will be required for future jobs and for the economic growth of the country.

The researcher chose the Network Society Theory on the basis that today's teachers and learners are part of the network society which is using ICTs in all spheres of life. Secondly, South Africa has shortage of adequately trained teachers in urban and rural schools due to the segregated education systems of the previous South African government. Therefore, ICTs in the researcher's view, are seen as a solution for the professional development of teachers and to equip them with the knowledge they require to be able to teach their learners. The theoretical framework that underpins this study will be discussed in Chapter 2.

1.4   PROBLEM STATEMENT

Given the significance of the new technologies of information in the creation of the knowledge and network society, schools are seen as suitable and relevant places to equip learners with the necessary skills to enable them to participate fully in the new knowledge economy. Thus, in terms of ICT use in education, some of the South African national goals are aimed at producing learners with 21st century skills to prepare them for participation in the knowledge and networked society before they leave Further Education and Training (FET) institutions (DBE 2004:14). Another aim of ICT use is to encourage learners to be knowledge creators instead of passive recipients. In an attempt to achieve such aspirations, many urban schools in South Africa are furnished with ICT infrastructure for implementation in the educational context.

Despite having the new technologies at their disposal, not all South African teachers have embraced them, and there appear to be two polarised camps. The first camp comprises immigrant digital teachers who cling to traditional teacher-centred approaches despite their learners being digital natives and the unavoidable presence of the new technologies. The second camp is described as the Y-generation learners who regard ICT as part of their culture. These learners are inquisitive in nature and use technology wherever and whenever possible for efficient and effective learning. While teachers are against any form of transformation especially the integration of ICT into teaching practice, their learners use

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technology wherever and whenever possible for efficient and effective learning. According to Sithole, Ikotun and Onyari (2012:3), the Y-generation is competent with sophisticated technology, requires technology and media for learning, are independent problem solvers, value team work and engage in multitasking. On the other hand, their older teachers are baby boomers and traditional intellectuals who shun the use and integration of ICTs in their teaching responsibilities.

The reluctance of older teachers to use ICT is referred to by Pegler, Kollewyn and Crichton (2010:457) who confirm that non-millennial teachers are ICT immigrants and therefore reluctant to embrace ICTs in their practices. Although learners and their teachers differ in terms of technological expectations, they need each other. On the one hand, teachers should be there for their learners as guides, mentors and learning facilitators; on the other hand, they must allow themselves to be mentored by their digitally savvy learners so that they too can acquire the digital skills to utilise the technological tools effectively (Noel, 2014:60).

Given the nature of contemporary social structure and the type of workforce required in the global economy, teachers have to be part of the network society and engage in lifelong learning. The global economy expects teaching professionals to facilitate pedagogical activities in order to produce "self-directed" learners, who will be skilled in executing ICT related activities and able to do jobs that do not yet exist.

Many urban schools in the Gauteng Province are equipped with ICT resources and have internet connectivity. This is in accordance with the South African eLearning policy initiative (DBE 2004:17) that focuses on equipping every South African learner in the General Education and Training (GET) and FET bands to master and use ICT confidently and creatively. The national ICT in education policy (DBE 2004:19) and the GDE eLearning policy (GDE 2007:5) further state that ICTs must be integrated for teaching and learning in all the grades for the improvement of education. However, the problem encountered in some ICT resourced schools is that these facilities are not being adequately utilised. Research (Mlitwa and Koranteng 2013:1; Tire and Mlitwa 2008:151) corroborates ineffective use of ICT in

schools, stating that in a township school with computers, half the computers are not in use due to lack of software.

Mdlongwa (2012:4) indicates that the introduction of ICTs in schools poses a major challenge in that ICT-based methods of teaching are resisted by teachers due to fear of change and inability to cope with the new technologies. Mlitwa and Koranteng (2013:9), Ndlovu and Lawrence (2012:5), and Mdlongwa (2012:5) state that many South African teachers in rural and urban schools are confounded by ICT and at entry level in terms of ICT use. Thus, these teachers lack the skills to create learning activities that promote learning with new ICT tools. Despite having teachers who do use ICTs for teaching, Mlitwa and Koranteng (2013:9) found the majority of teachers in ICT resourced schools are not computer literate and are afraid of using computers.

This constitutes a problem in that teachers have neither the necessary skills nor required knowledge to integrate their pedagogic knowledge with the new technology. In certain schools the computer laboratories are used as ordinary classrooms for Mathematics and Science and are accessed only by teachers who offer these subjects. This implies that other subjects are excluded and some teachers do not even consider using available ICTs. Based on the above mentioned reasons, the researcher explored teachers' experiences of ICT usage in teaching and learning in urban schools

1.5 RESEARCH QUESTIONS

Against this background the main research question was formulated as follows:

What are teachers' experiences of the use of ICTs in teaching and learning?

The following sub-questions were posed to explore the main research question further.

- What theories endorse ICT use in teaching and learning?
- What is the ICT proficiency level of teachers in ICT usage in teaching and learning?

- What are the factors that impede or promote ICT use in an educational environment?

- What recommendations can be made to improve teachers' ICT proficiency?

1.6 AIMS OF THE STUDY

The main aim of this study was to explore teachers' experience of ICT usage in teaching and learning. The intention was to establish how teachers perceive ICT use in South African public schools and to determine the factors that influence ICT integration in teaching and learning. The importance of acquiring such data may inform authorities on cultivating appropriate professional development for teachers. The data can also inform further research needs as far as ICT usage in schools is concerned.

From this broad goal the operational goals that needed to be achieved are as follows:

- To determine theories that endorse ICT use in teaching and learning.
- To determine the ICT proficiency levels of teachers and learners.
- To establish the factors which impede or promote ICT use in an educational environment.
- To make recommendations regarding the integration of ICT in education.

1.7 SIGNIFICANCE OF THE STUDY

The purpose of the study is to explore teachers' experience in using ICT in the schooling system. It seeks to investigate, describe and analyse perceived teacher behaviour towards using ICTs, the factors that impede or promote ICT integration in schools, and the challenges and successes experienced by teachers in incorporating and using technology facilities and tools in the school curriculum. It investigates characteristics associated with teachers who successfully integrate ICTs in facilitating teaching and learning.

The significance of the problem is therefore directed at analysing the research findings and drawing conclusions and recommendations to ensure acceptance and adoption of ICT to

promote and sustain ICT usage in teaching and learning. It is hoped that the research findings will be utilised in the professional development of teachers regarding ICT use in teaching and learning in primary and secondary schools in South Africa.

1.8   RESEARCH METHODOLOGY

1.8.1   Research paradigm

Research paradigms are classified into three basic categories of positivism, interpretivism and critical science and all represent different ways of seeing the world. According to McMillan and Schumacher (2010:5) positivism maintains that humans must be studied in the same way as the study of nature as scientific knowledge is regarded as facts and reality is seen as independent of social construction. In critical science people understand how the society functions and the methods by which unsatisfactory aspects can be changed. Unlike the other paradigms, interpretivism is an approach in which individuals seek to understand their world and they develop subjective meanings of their experiences (Creswell, 2007:20). De Vos, Strydom, Fouche and Delport (2011:65) concur and maintain that the interpretivist paradigm elicits participants' accounts of meaning, experience or perceptions.

This study is situated in the interpretivist paradigm as it is concerned with teachers' perceptions, attitudes and interpretations regarding the use of ICTs in their teaching practice. The discussion in the subsequent paragraph handles the research design of the study.

1.8.2   Research design

McMillan and Schumacher (2010:20) describe research design as procedures for conducting a study. The aim of a research design is to specify a plan to enable the researcher to generate empirical evidence that will be used in answering the research questions. Quantitative research, qualitative and mixed method approaches are the three main categories of research designs (McMillan and Schumacher, 2010:11). Contrary to the other research designs, the qualitative approach rests on the assumption that knowledge is

socially constructed as individuals are inclined to understand and make meaning of the world they live in. Another important characteristic of qualitative approach is that the inquiry occurs in a natural setting while behaviour is studied as it happens (De Vos *et al*., 2011:65). The description and the explanations of the participants, the natural milieu and the social construction of knowledge enable the researcher to understand the participants' words and to report the various social realities.

The research design for this study follows the qualitative approach as it probes teachers' experience in terms of ICT usage in teaching and learning at school. In this study teachers are considered to be rich in information with regards to the use of ICT facilities as stipulated in the policy. Thus, their experiences, views and opinions are bases for constructing information that will be used to answer the research questions outlined in section 1.5. The information gathered from teachers was used by the researcher to create knowledge from various descriptions and explanations of ICT usage in urban schools.

The case study strategy was chosen as the relevant research type for providing the required information pertaining to the research questions and to develop a full understanding of ICT use in teaching and learning. McMillan and Schumacher (2010:344) and Babbie (2010:309) describe a case study as an in-depth examination or analysis of a single instance of some social phenomenon.

In this case study individual teachers and principals have been chosen as the participants. They were selected because they facilitate the use of ICT in schools and are instrumental in realising its benefits in attaining desired educational skills and outcomes. Through interviewing each participant, the researcher was able to acquire in-depth information about the participants' multiple realities.

1.8.3   Population and sampling

Babbie (2010:199) and McMillan and Schumacher (2010: 129) describe population as a group of elements, cases or individuals that conform to specified criteria and to which researchers intend to generalise the findings of the research. The research population for

this study was all schools with ICT resources for teaching and learning, principals and teachers who, in one way or another, use ICTs for teaching and learning. However, cognisant of the constraints of time, resources and the impossibility of engaging all schools, the researcher used her judgment to identify and select accessible teachers and principals in terms of the location of the school and the time scheduled for the interviews. Another characteristic of interest for this study was the participants' common attribute of engaging with ICTs in the school environment.

The research sample size in this case study consisted of five primary school teachers, five high school teachers and five school principals. In this study *high school* was preferred to *secondary school* as the schools were known as such. Of the five principals, three were primary school principals while two were high school principals. Together they constituted a case study which, according to the researcher, was appropriate to yield rich and relevant information regarding the use of ICTs in schools in order to answer the broad research question and the subsidiary questions as indicated above in subsection 1.5.

The selected teachers were those who have computer laboratories and computer tablets at their schools. The principals were chosen by virtue of being transformational and ICT leaders in their schools. In concurring with this assertion, research (Shan Fu, 2013:117; Kannan *et al.*, 2012:111; Papaioannou and Charalambous, 2011:353) indicates that school principals can be described as ICT leaders if they ensure ICT integration at school by executing ICT related responsibilities. Therefore, it is incumbent upon the principal to ensure that teachers effectively use ICTs to provide better instructional methods to enhance and engage learners in constructivist learning experience to achieve educational outcomes.

The researcher used purposive sampling in selecting the schools and the participants for inclusion in this research project. Babbie (2010:93) defines purposive sampling as a form of nonprobability sampling in which units to be observed are selected on the basis of the researcher's judgment about which ones are the most useful or representative. Based on the researcher's judgment, the schools that were chosen for this study are those schools that have ICT infrastructure and teachers have been trained on the implementation of ICT in teaching and learning matters. The primary and high schools chosen for the study are in

Mamelodi Township, in Gauteng Province, situated in the eastern side of Pretoria, South Africa.

The rationale for choosing these schools was that they have well-equipped computer laboratories, tablet computers with educational software and internet connectivity for teaching and learning. These high schools were in partnership with Motorola Philanthropy - Ulwazi eLearning Project, Meraka Institute which was established as a part of Centre for Scientific and Industrial Research (CSIR) and have received assistance from St Alban's College, an independent school in Pretoria. In addition to its core business of teaching and learning, this college engages in educational enhancement at state schools in its vicinity. Teachers at neighbouring township schools are also assisted with regard to the integration of ICTs into their teaching.

1.8.4 Data collection strategies and analysis

Data collection comprises of interrelated activities aimed at gathering relevant information to answer research questions (Creswell, 2007:118). Qualitative researchers often use information that comes from direct sources by using data collection strategies such as observation and interviews. Prior to the empirical investigation, the researcher conducted a literature study on the use of ICTs in education globally and in South Africa in particular in order to gain a deeper understanding of ICT usage by teachers. The literature study was followed by the empirical investigation in which semi-structured interviews were conducted for collecting data. Research data was analysed through coding, categorisation and thematic analysis as advocated by MacMillan and Schumacher (2010:370-377). Other data collection techniques included non-participant observation, literature studies and document analysis for triangulation purposes. To ensure that the research findings are credible and trustworthy so that they can be beneficial to other researchers and interested parties, trustworthiness was ensured through piloting of the interview questions to provide an opportunity to clarify and modify difficult questions, iterative questioning, member checking and triangulation.

1.9   THE RESEARCHER'S ASSUMPTIONS ABOUT THE STUDY

The purposive sampling of school teachers and principals was informed by the researcher's personal assumptions which are listed as follows:

- School communities adhere to the DBE and GDE ICT in education policy.
- Schools have the necessary ICT equipment for teaching and learning.
- Schools have school-based ICT policy to ensure ICT integration across the curriculum.
- Principals are ICT leaders in their schools.
- Teachers are computer literate.
- Teachers are able to integrate ICTs with their teaching strategies.
- Learners are familiar with and capable of using a variety of technological tools.

1.10   DELIMITATIONS AND LIMITATIONS OF THE RESEARCH STUDY

Delimitations are characteristics that limit the scope and define the boundaries of the study (Simon, 2011:2). This research study involved five primary schools and five high schools which are public schools situated in Mamelodi Township. These schools are under the jurisdiction of Tshwane South District in Gauteng Province of South Africa. The researcher interviewed five primary school teachers, five high school teachers, three primary school principals and two high school principals.

Although the research sample is small and the selected schools are from the same township, the goal of this qualitative analysis is not to generalise, but to provide a richly contextualised understanding of the attitudes and issues surrounding the use of ICTs in the research sample. Based on the findings for this research project, the next step would be to find out to what extent these findings can be extrapolated and extended to other South African urban and rural schools that have ICT infrastructure for teaching and learning.

The limitation of this study was time. The duration of the study was short so the information obtained could be a fraction of many more things that are occurring in schools regarding the use of ICTs. This is confirmed by Simon (2011:2) where she asserts that a study done over a period of time is a snapshot dependent on conditions occurring at that time.

1.11 ETHICAL CONSIDERATIONS

In conducting qualitative research, the researcher is bound to ensure that the ethical issues are taken into consideration. Cognisant of what is required in conducting an educational research and since the intended study focused on teachers and principals, the researcher was obliged to protect the rights and the welfare of the participants. As a student, the researcher received ethical clearance from the College of Education at the University of South Africa (UNISA). Permission was also obtained from GDE and Tshwane South District to gain access to the schools to interview the teachers. Permission was obtained from the school principals and teachers in writing. The interviews were conducted after school hours with teachers and principals at convenient times because the researcher did not want to interfere with the smooth running of the schools. The researcher got the consent of all participants by means of the consent forms that the participants received prior the interview sessions and informed participants of anonymity and confidentiality. The reason was to get candid responses to more sensitive issues.

1.12 TRUSTWORTHINESS

In quantitative research the concepts of reliability and validity are important qualities when determining rigour in the research activity and are also the means of creating objective scientific knowledge. According to Babbie (2010:150-153), reliability refers to whether a particular technique yields the same results each time it is used while validity is described as a measure that accurately reflects the concept it is intended to measure. In accordance with this definition, it is the responsibility of the researcher to ensure that the data gathering instruments are reliable and that the results are valid so that they can be considered to be the truth and can be applicable in similar contexts.

Based on the different worldviews of the positivist paradigm and the naturalist paradigm, reliability and validity are not considered relevant in qualitative studies where the concepts used to denote rigour and trustworthiness are credibility, transferability, dependability and confirmability (Given, Winkler and Willson, 2014:9; De Vos, 2011:419- 421). In this study, the techniques for ensuring rigour and trustworthiness included preliminary visits by the researcher to the participants to develop early familiarity with them in order to establish a relationship of trust. This was followed by the selection of research participants who could provide appropriate data to answer the research questions, piloting the interview schedule using reiterative questioning, member-checking and triangulation in order to confirm the findings with information from literature studies.

1.13   CLARIFICATION OF TERMS

Definitions of terms are necessary for the purpose of elucidating what is relevant in the research. For the purpose of this study the following key terms are defined as follows:

1.13.1   Information and Communication Technologies

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) defines information and communication technologies (ICTs) as diverse sets of tools and resources used to communicate, create, disseminate, store and manage information (UNESCO, 2008:11). These technologies include computers, the internet, broadcasting technologies and telephony. ICTs are viewed differently by various sectors of the society. In education these tools are significant in helping teachers to employ innovative strategies to enhance the teaching and learning processes in schooling. Teachers and learners use ICTs such as computers, cellphones, interactive white boards, digital cameras and digital projectors to communicate, disseminate, store and manage information. ICTs also make it possible for learners to access learning.

1.13.2   eLearning

eLearning is the amalgamation of modern technology in the classroom which can sometimes include learning that is completely independent of mediation (Ouma, Awuor and Kyambo, (2013:1; Moore, Dickson-Deane and Galyen, 2010:130). It is also defined as a computer-based educational system that encompasses formal and non-formal learning at all levels, and uses a local network or the internet, intranet or extranet for the delivery of content and interaction between learners and teachers, and between learners and the content (Epignosis LLC, 2014:5; Moore *et al.*, 2010:130).

In the context of this study eLearning is synonymous with online learning, computer-aided instruction, computer-aided learning, web-based learning, web-based training and resource-based learning.

1.13.3   Experience

Experience refers to knowledge or skills gained through being involved in or exposed to something over a period of time. It also refers to personal perceptions that arise from a complex interplay among physiological, cognitive and situational variables, which bring about diverse expression of behaviour. It is the purported wisdom gained in the subsequent reflection on those events or interpretation of them.

1.13.4   Urban schools

Urban schools, in this study, refer to schools established for learners living in Gauteng urban and township areas. These schools were established as a result of the Bantu Education Act of 1953, which widened the gaps in educational opportunities for different racial groups. Most black urban schools are characterised by lack of facilities, lack of funds, low pass rates and poorly trained teachers (Mlitwa and Koranteng, 2013:9; Mdlongwa, 2012:2; Ndlovu and Lawrence, 2012:2). The use of ICTs in poorly resourced schools often located in poor rural or urban areas, is therefore viewed as a means and a panacea to overcome the educational ills that negatively impact teaching and learning.

1.13.5   Teacher

A teacher is a person who has qualifications or credentials from a university or a college to educate others. The role of the teacher is formal and ongoing, carried out by way of occupation or profession at school or at any other place of formal education. Du Plessis, Conley and Du Plessis (2007:3) describe a good teacher as the teacher who helps learners to participate in the process that makes possible the establishment of knowledge.

According to the network society, the teacher in an ICT-based environment should be computer literate, information literate and know how to integrate the teaching methods with technology. These ICT competencies enable the teacher to design learning activities using ICT tools so that the learner becomes more motivated, independent, active and is enabled to create his or her knowledge. Therefore, the presence of ICTs for use in teaching and learning emphasises the new role of a teacher as a guide, counsellor and coordinator. The role of the teacher also includes encouraging critical thinking skills, problem solving and collaboration among learners.

1.13.6   Teaching

Teaching refers to the actions of a real live instructor designed to impart knowledge to the learner. According to Du Plessis *et al*., (2007:2) teaching is a human undertaking with the aim to help people learn. Teachers are professionally trained people equipped with skills and the expertise to teach, educate or train other persons at an educational institution in order to satisfy a specific need (ELRC, 2003:A3-5). Teaching therefore is a process that helps learners to acquire skills and attitudes in order to grow into useful members of society. The significance of integrating ICTs in teaching is a practical way of preparing learners and students for the information society and to participate in the global market.

1.13.7   Learning

Learning can be seen as a lifelong process of skill acquisition and increased fluency. Du Plessis *et al*. (2007:3) state that learning involves change in a person as regards their insight,

behaviour, perception or motivation, and that this change leads to added knowledge or the ability to do something that the learner could not do before.

This indicates that the person gains knowledge of what they did not know before, the attitude changes and has the ability to perform something. Learning with ICT denotes that the learner uses ICT equipment to acquire knowledge, interact with the tools, with the teacher or with other leaners. The nature of ICT also allows the learner to engage with online information without the presence of the teacher.

Such learning is referred to as online learning, web-based learning, distance learning, or computer-based learning. All these various forms of learning allow learners to become knowledge constructors and learn at their own pace.

1.14   OVERVIEW OF THE STUDY

This dissertation is divided into six chapters:

Chapter 1 introduces the research project and states the overall argument for why the dissertation was undertaken. It presents the background information which highlights the importance of integrating ICTs in various education systems in order to improve the quality of teaching and learning and realise the establishment of the knowledge society. The problem statement and sub-research questions are based on the need to conduct this study. This is followed by the formulation of the aim and objectives of the study and a discussion of the research methodology used to answer the research questions and achieve the research aim. The chapter concludes with a description of important terms related to the study.

Chapter 2 examines learning theories and the social theoretical framework underpinning the use of ICTs in education. Behaviourism, constructivism, connectivism are the learning theories which are examined in terms of ICT usage in the learning processes and teaching strategies. They are compared and critiqued to determine if they are relevant to learning in the 21st century. Based on the potential of various ICTs to accommodate all three learning

theories, the study indicates these theories prove equally valuable and relevant to 21st century learning. The network society theoretical framework emphasises ICT usage by the teachers and the learners for knowledge construction, sharing and distribution in order to be in line with the requirements of the global society (Aguti 2016:2).

Chapter 3 is a literature review of ICT usage in general and specifically in teaching and learning. Literature on the use of ICTs in three education systems, the Scottish, Ghanaian and South African education systems, is presented to investigate the similarities and differences in terms of ICT integration in First World and African countries. The study of these countries is used to determine how ICTs can be used to yield positive results so that the struggling countries can learn from the strategies employed by a country which has experienced the successful integration of ICTs in teaching and learning. Literature that highlights the impact of ICTs on learners and teachers' use of ICTs is examined in order to gain information to answer the research question. The chapter also deals with the role of school principals as ICT leaders at schools and finally it deals with the factors that promote or deter ICT usage in teaching and learning.

Chapter 4 is a discussion of the research design employed to investigate the use of ICTs in black urban schools in Gauteng and includes the rationale for the choice of a qualitative approach. It also focuses on population and sampling, the research site, instruments for data collection which are semi-structured interviews, non-participant observation and the analysis of documents. It then goes on to deal with the analysis of data, validity and trustworthiness of the study and the analysis of the research data. Finally, the chapter considers the ethical issues that are taken into account in the study.

Chapter 5 provides the discussion of data analysis and presents the findings that emanate from the empirical investigations, non-participant observation and the document analysis. Recurring patterns or themes made it possible to organise the data thematically, and the discussion analyses the themes captured in interviews with ten teacher participants and five school principals, as well as the analysis of documents pertaining to ICT usage in urban schools. The findings are presented, discussed, analysed and interpreted in line with the

objectives of the study in order to answer the main research question and the subsequent research questions.

Chapter 6 comprises a synopsis of the findings of the investigation as well as the recommendations arising from the study. It presents a discussion of the conclusions of the study as they relate to the research questions and discusses the limitations of the study. Recommendations that might encourage teachers to integrate ICTs in teaching and learning are made and finally it makes suggestions for further research.

1.15   CONCLUSION

The study examines teachers' experiences in handling ICTs in the classroom and the aim of this chapter was to give a brief background to the study which explains why and how ICT impacts our lives as well as the necessity of integrating them in teaching and learning if educational standards are to be enhanced and raised. The theoretical framework which endorses ICT integration in education with the aim of enhancing the learning process for learners with different potential is also highlighted. This chapter delineates the problem to be investigated, the research aims and the objectives. Furthermore, the chapter outlines the significance of the study, the research methodology focusing on the relevant research paradigm, the research design, the population and the data collection strategies. Ethical issues that regulate the research endeavor are referred to. The chapter defines key terms that are of importance to this particular study, the organization of the study and the conclusion.

The next chapter focuses on learning theories, social network theory and the impact of teaching and learning with ICTs.

CHAPTER 2

THEORETICAL FRAMEWORK FOR ICT USAGE IN TEACHING AND LEARNING

2.1   INTRODUCTION

The previous chapter provided an overview of what the researcher intends to investigate regarding the use of ICTs in teaching and learning in urban schools. This chapter examines the phenomena of teaching and learning in the 21st century, and this is followed by a discussion of the various learning theories in relation to the use of ICTs in teaching and learning. The chapter then turns to network society theory, a theory of societal organisation which endorses the integration of ICTs in the schooling system for effective facilitation, active participation, collaboration and knowledge creation as well as the realisation of the knowledge society. The chapter concludes with an indication of how various ICTs can be used in educational settings where different learning theories are used for effective teaching and learning to occur.

2.2   EDUCATION AND THE INFORMATION AGE

The new social structure, ICTs, globalisation and the new knowledge economy have ushered in changes in the education fraternity. These changes impact on teaching and learning and call for the transformation of the education system. The significance of the transformation is to enable teachers and learners to acquire skills and knowledge deemed relevant in the information age (Hallissy, Butler, Hurley and Marshall, 2012:9; Cavas *et al*., 2009:21).

Writing in favour of the renewal of the school curriculum, Saavedra and Opfer (2012:8) endorse curricula which are relevant to learners' lives and aim at addressing learners' needs, 21st century skills and knowledge through the use of technology. Consequently, schools are obliged to use constructivist approaches mediated through ICTs to allow learners to set their own goals, plan their activities and to monitor their levels of mastery and understanding of the learning material. Within the modern age, learners are also expected to be active participants in their learning activities rather than passive recipients of information from authoritative teachers. Other important features for education in the information age is the

facilitation of active and authentic learning to create a situation in which learners engage in cooperative learning and use high order thinking skills throughout their educational experience. According to Aktaruzzaman, Shamim and Clement (2011:117), these qualities are of great importance in 21st century education and deemed essential in preparing the learners for their future workplace in the network society where ICTs are ubiquitous.

The DBE in South Africa has shared the need to transform its education system as evidenced by the introduction of Curriculum 2005 (C2005), which saw the implementation of Outcomes-Based Education (OBE) in the GET band in 1997 with full implementation in Grade 12 by 2005. OBE replaced the race-based education system with one designed to cater for all South African learners irrespective of colour and socio-economic background. This new educational dispensation focused on addressing skills, knowledge and values and aimed at promoting learner-centred pedagogy through a system of specified critical outcomes which included teamwork, critical thinking skills and problem-solving skills (Msila and Netshitangani, 2014:280; Sayed and Ahmed, 2011:110). Despite high educational expectations, OBE was deemed a failure due to implementation problems such as inadequate teacher development, learning at own pace and complex policy (Mouton, Louw and Strydom, 2012:1214). The failure of OBE was predicted by Janssen (1997:5) who said it would fail because it was based on flawed assumptions about what happens in schools, the organisation of the classrooms, and the types of teachers in the system.

The review of C2005 led to the Revised National Curriculum Statement (RNCS) in 2002 which was intended to have a clear structure, be written in simple and understandable language, with overall intentions geared at promoting conceptual coherence, social justice, equity and social development through the development of creative, critical and problem-solving individuals (Maluleka, 2015:2). RNCS acknowledged that OBE's notions such as "own pace" were impossible. Mouton *et al.* (2012:1215) mention that the challenges resulted in loss of confidence in state schools in favour of independent schools among government leaders, teachers, parents and learners. According to Sayed and Ahmed (2011:107) and Frempong, Reddy and Kanjee (2011:822-833), the major problems that continue to plague South African education are quality, equity and relevance. The persistence of the problems led to the development of yet another curriculum, the Curriculum and Assessment Policy

Statement (CAPS), which was developed in 2011 with the intention of improving the quality of teaching and learning in schools (DBE 2011:i). The changes in the new curriculum included emphasis on content knowledge, the structured pacing and sequencing of the curriculum, commitment to active learning and commitment to environmental content in a number of subjects. The implication for the policy makers and the education authorities with regards to CAPS was also destined to reflect a satisfying education, a changed society and democratic diversity (Msila and Netshitangani, 2014:281).

Instead of being a boon to the South African education system, the introduction of two different education systems within a short space of time only added to the national challenges and reflects the pitfalls in terms of planning and execution. The introduction of new education systems constituted a major challenge for teachers who never got to grips with the principles of the post-1994 curriculum systems. The never-ending changes introduced by the education ministry have resulted in under-performance by both South African teachers and learners which has disillusioned many stakeholders (Chigona, Chigona and Davids, 2014:5). This however should not deter stakeholders from seeking quality education. Educational innovations are required so that South African teachers and learners are in a position to compete with their peers from other countries in international education rankings. International standards require teachers and learners to be knowledgeable, adept at using ICTs, as well as creative and innovative in order to be producers rather than consumers of knowledge. Achieving quality education requires full participation and adequate planning to prepare the ground for implementation.

The GDE (2007:3) recognises the role and the potential of ICTs in the information age in enabling learners to do well at school and to be ICT literate for future careers. This is confirmed by the Member of the Executive Council (MEC) of GDE who emphasises the importance of every teacher and learner using tablets in all Gauteng schools to realise the educational benefits of ICTs. This is congruent with international trends in the information age. However, research findings (Tedla, 2012:200) have proved that ICT resources alone cannot enhance teaching and learning. Teachers need to be thoroughly equipped with ICT skills in order to be able to integrate with their pedagogical knowledge. Therefore, training

of teachers is of greater importance than before if they are to acquire the necessary ICT skills to be able to integrate them into their teaching practice as expected.

The researcher agrees with curricula innovations which include the use of technology for advances and better performance in teaching and learning. This could be of great value for South African teachers and learners to counter the educational challenges such as poor educational facilities, lack of adequately trained teachers and poor scholarly performance demonstrated by the majority of South African learners as indicated by Van der Berg, Taylor, Gustafsson, Spaull and Armstrong (2011:2). The notion of providing all schools and every learner with a tablet as well as educational software will remain a utopia in black schools given the conditions that have prevented the integration of ICT usage in urban and rural schools (Mooketsi and Chigona, 2014:7; Mlitwa and Nonyane, 2008:11). Consistent with the challenges that hinder ICT integration in the South African schooling system, Nkula and Krauss (2014:243-245) list the lack of technological tools, lack of infrastructure such as school buildings, teachers' fear of knowing less than learners, lack of ICT skills and confidence in teachers and poor teacher training as some of the barriers that inhibit the integration of ICTs in teaching and learning.

However, educational transformation in the information age calls for instructional strategies and attitudes that are relevant in order to actualise the nature of education advocated for the information age. The following section focuses on teaching in an ICT pedagogic environment and the circumstances that compel teachers to use ICTs in their teaching activities.

2.3   TEACHING IN THE 21ST CENTURY AND THE IMPLEMENTATION OF ICTS

It is clear from the discussion of education in the information age that South African schools not only lack the infrastructure, but also current teaching practices fall short of what is required to integrate ICTs into learning. This realisation has prompted the DBE (2004:22) and GDE (2007:18) to ask teachers to rethink and reshape their engagement with the curriculum in any encounter with ICT integration. The 21st century mindset also requires teachers to adopt and utilise ICTs in their teaching activities to help learners to develop the

potential and skills to function effectively in dynamic and information rich situations. This assertion is reiterated by Aguti (2016:2) Hunde and Tacconi (2013:707), Tedla (2012:199) and Mwalongo (2011:38) who state that teachers have a responsibility to promote creative and participatory learning, encourage the exchange of information among learners and prepare them to participate in a community of lifelong learners, something held in high esteem in global competitiveness.

Unlike the traditional teaching method of transmitting knowledge to learners who had to learn and reproduce content, 21st century skills demand that teachers guide learners to become actively involved in constructing their knowledge using all educational facilities available to develop higher-order thinking skills and problem-solving techniques. As a result, teachers' practices must be aligned with the expectations of the networked society which, according to Levinsen (2011:52), requires teachers to modify their traditional teaching methods so that ICTs can drive the learning process and adopt innovative teaching skills in order to accommodate the new generation of learners. Hunde and Tacconi (2013:719) further state that the successful use of ICT requires teachers to amalgamate technology with their knowledge of pedagogy, content and context.

The teacher's new role of a facilitator is geared to help learners achieve educational goals that are considered indispensable in the knowledge society (UNESCO, 2012:6). Based on the constructivist paradigm, teachers can actively engage learners in problem-solving activities which require learners to apply their higher-order thinking skills in an innovative and creative manner. These are the qualities which are expected by employers in future jobs for economic and social growth. The role of the teacher also engages teachers as co-learners and lifelong learners. Interacting with the new knowledge is characteristic of the 21st century teacher and contributes to teacher development. Sharing knowledge with experts and colleagues by using social network forums is deemed necessary for teachers' professional development (Uche, Kaegon and Okata, 2016: 90).

Another factor in the researcher's opinion that adds to the transformation of teaching in the new age is the digital generation learners who are accustomed to interact with ICTs with ease and multi-task at the same time. 21st century children are said to be more comfortable

working on the keyboard than writing in a book, and to enjoy reading from a screen rather than a book. Digital learners are also characterised as having constant connectivity - in touch at anytime, anywhere. This is confirmed by Livingstone (2012:11) who states that the internet enables the widespread sharing of valuable resources and affords collaborative learning distributed over time and place as needed by the users.

The qualities of the digital generation learners require teachers to meet the needs of all learners and move them toward fulfillment of their individual potential. In order to achieve this outcome, teachers are expected to use teaching skills that enable learners to solve complex problems, apply and transfer learned skills to other learning contexts. In the light of the expectations and the problems encountered in educational situations, teachers must prepare for a technology rich future and keep up with the change by adopting effective strategies that infuse lessons with appropriate technologies to enhance educational outcomes across the curriculum. This is confirmed by Aguti (2016:1-2) who states that teachers are obliged to have ICT integration and digital competencies in the 21st century in order to introduce ICT skills to their learners from the primary school phase and to prepare them for the job market.

Previous literature (Tedla, 2012:199) states that the integration of ICT helps to meet the expectations imposed on teachers, since the various technological tools can help teachers to create more learner-centric environments and make a positive difference in education. According to Sipilä (2014:3), research findings reveal that ICT as a teaching tool in the classroom provides teachers with opportunities and support for their teaching which culminates in enabling learners' understanding of what they are taught while teachers are assured of achieving their educational outcomes.

Learners' performance in science and mathematics is a serious concern to the Tanzanian educational authorities and the government (Kafyulilo and Keengwe, 2013:3). As such the use of ICT in these subjects is regarded as a solution to help learners master the concepts and the processes required (Shin, Sutherland, Norris and Soloway, 2012:551). The teachers' role is to provide fast and accurate feedback and concentrate on allowing learners to engage in active learning strategies for better understanding and the best performance.

Teachers can be seen as agents between technology and learners and they need to integrate technology to facilitate active and authentic learning, use technology to create cooperative classroom activities for learners to work together and be able to use high order thinking skills throughout their educational experience (Hunde and Tacconi, 2013:708; Cavas *et al*., 2009:20).

Although the use of ICTs is regarded as indispensable in the 21st century and in the information society, the researcher's contention is that the new role of a facilitator does not obviate the need for teachers to serve as leaders in the classroom and to use traditional skills and practices as well. The researcher believes that traditional skills and practices are still important, but that technology should be incorporated to help to achieve educational goals. The role requires the teacher to select and integrate ICT tools effectively to enhance and expedite the process of learning. The importance of ICT and learning in the 21st century is dealt with in the next section.

2.4   LEARNING IN THE 21ST CENTURY AND THE USAGE OF ICTS

Using ICTs for effective engagement in the learning process to improve learning is also the responsibility of the learner. Just as teaching is impacted by the new social organisation and the introduction of ICTs, learning is greatly affected by the new technology, both to enhance performance and attain educational outcomes as the emphasis shifts from rote learning to interactivity, authentic, anchored, virtual learning and collaborative learning (Saavedra and Opfer, 2012:16).

Learning with ICTs is endorsed by the type of learners found in the new information era and technological gadgets form part of their daily lives. Today's children encourage the limitless use of ICTs in schools and this is attributed to the fact that the internet plays a major role in their relationships with friends, their families and their schools. The nature of the digital generation is illustrated by Cavas *et al*. (2009:21) who state that Turkish learners use computers and the internet to interact with fellow learners and also to achieve their own learning needs and goals.

Although factors such as the economic context of South Africa and uneasy or partial access to the internet play a major role in determining ICT usage in the school system, Mdlongwa (2012:5) and Draper (2010:33) report that many South African learners use the internet to do research, to find general information and for assisting them with mathematical and language related issues, for social networking in order to conduct discussions and to access quality and authentic learning material to help them with their school or homework. According to Osman, El-Husein and Cronje (2010:19) through Mobile-learning (mLearning) many learners receive content instruction and information wherever they find themselves. This is beneficial for students in distance learning and provides learning opportunities for the students who are economically disadvantaged. Through smart cellular phones, learners engage in mLearning which allows them to send wireless messages and chat about schoolwork and other matters over cellular phones every day.

According to Mayisela (2013:5), mobile technology and social networks such as Facebook provide the students with the opportunity to access courseware even when the students have missed classes for one reason or another. The availability of the Tshwane Free Wi-Fi is currently benefitting learners, students and those around the city of Tshwane (Alfreds, 2015). Tshwane free Wi-Fi was launched by the City of Tshwane in Gauteng Province to provide free internet connectivity to residents and students in open public spaces for education and economic advancement purposes. In the same vein, the intention of Project Isizwe (SA Government online: 2015) provides internet access to rural areas in South Africa giving every South African learner or student the opportunity to acquire 21st century competencies. This is corroborated by the report that many South Africans living in urban and rural communities are able to explore, share, and access digital information through mobile and computer internet connectivity (UNICEF, 2012:5).

Although ICTs have resulted in ubiquitous learning and have introduced innovative, productive and interactive ways of learning among learners, the researcher's observations regarding the use of ICTs in urban as well as in rural South African schools is that there is a lack of access to ICT tools and most teachers still use the traditional methods of chalk and talk. The lack of computer skills on the part of teachers is an issue in the implementation of eLearning. Over and above these obstacles, the different provincial education departments

in South Africa are plagued with the challenge of not being able to implement the ICT eLearning policy due to lack of funds and poor training schedules for developing teachers (Mdlongwa, 2012:2; Makgato, 2012:108).

In spite of having ICTs for teaching and learning in many South African urban schools as per the ICT in education policy, challenges, such as poor ICT skills and the sense of disempowerment, render the use thereof ineffective (Chigona *et al*., 2012:116). As stated by Shan Fu (2013:117), the availability of ICT alone cannot transform teaching and learning, as it is the teacher who determines the success or the failure of ICT use in the classroom. It is incumbent upon teachers to follow the principles and the techniques of various learning theories and select relevant ICTs which will facilitate learners' understanding and enhance the art of learning. The various learning theories which include behaviourism, constructivism and connectivism are paradigms which can be applied effectively with the use of appropriate ICT to enhance teaching and learning and to elicit educational outcomes which are stipulated as 21st century skills. These learning theories will be discussed in the subsequent paragraphs.

2.5 LEARNING THEORIES IN THE CONTEXT OF IMPLEMENTING ICTS IN THE 21ST CENTURY

A learning theory is defined by Begg (2015:70) as a logical framework of how we come to know about learning. Behaviourism, constructivism and connectivism are learning theories which can be applied in learning situations to cater for the needs of different learners with different learning potential to achieve intended educational goals and schools are using diverse theories to adapt to the new network society (Altuna and Lareki, 2015:2). Firstly, these different learning theories are of great importance as they are universal models which explain how the learning process occurs in learners with different potentials and learning styles and are designed to benefit all learners by creating instructional environments. Secondly these theories, by their unique nature, can incorporate and justify the use of ICTs as teaching and learning tools in the educational milieu. These three broad learning theories are characterised by particular principles and techniques which indicate to the teacher the instructional strategies and principles to use in teaching learners and also indicate what

learners should be able to do in order to demonstrate that learning has indeed taken place. The change in behaviour and the processes of knowledge acquisition, application, knowledge construction and meaning attribution are learning outcomes which can be attained as a consequence of exposing the learner to particular learning content.

Since they were found applicable to this study, the main learning theories describing the learning process and providing teachers with instructional techniques to facilitate learning are behaviourism, cognitivism and constructivism, (Duke, Harper and Johnston, 2013:5; Ertmer and Newby, 2013:43). The ubiquitous nature of ICTs in knowledge creation, sharing and distribution has led to the development of yet another learning theory, connectivism. Literature (Tay, Lim, Lim and Koh, 2012:740; Dede, 2008:44) indicates that the various pedagogies can be used with relevant ICT tools to achieve the intended goals and the 21st century learning skills. For the purpose of this study, behaviourism, constructivism and connectivism are learning theories that will be explored as they impact teaching and learning in the ICT integrated learning situation. The discussion will address learning with ICTs from the behaviourist point of view and the more modern school of thought which includes constructivism and connectivism in regard to learning and teaching with ICTs.

This section will not focus on the differences of the learning theories in detail but will highlight the importance of the various theories in teaching and learning environments. Teachers should be made aware of the importance of all learning theories and understand that the teacher will be guided by the type of learners, the available ICT techniques and the subject matter when it comes to selecting which paradigm should be used in a particular pedagogical situation.

The integration of technological tools for teaching and learning should be informed and guided by the principles of the specific learning theories. Behaviourism as the theory which puts more emphasis on the teacher and the objectives of the lesson will be dealt with first to indicate its impact on teaching and learning and also how various ICTs can enhance teaching and learning in the teaching environment. The discussion of the learning theories will be concluded with a tabular summary of the theories discussed in this study.

2.5.1   Behaviourism

Behaviourism is based on Skinners' (1968) stimulus and response theory. The learner is seen as conditioned by stimulus to respond in the manner that is anticipated by the teacher. According to Ertmer and Newby (2013:50) and Brown (2006:110), this implies that the learner is not responsible for his learning but learning is engineered by the teacher who delivers a particular learning content, assesses and reinforces the learner's response.

Learning in this school of thought is indicated by a change in the behaviour of a learner (Altuna and Lareki, 2015:3; Skinner 1968; Brown, 2006; Dede, 2008) and it happens solely through a system of positive and negative rewards. This clearly indicates that emphasis is on prediction and control of human behaviour in which introspection and independent thinking form no essential part of its methods (Ertmer and Newby, 2013:51; Dede, 2008:46). The desired response in behaviourism is affirmed by using reinforcements to ensure that the same behaviour recurs. In education teachers who believe in behaviourist pedagogy use rewards and punishments as reinforcements for performance in the classrooms. This is also done by promoting learners to the next class or grade as a gesture of rewarding good performance and punishing inappropriate ones by failing learners who are underperforming.

Behaviourism is the learning theory into which ICTs as stimuli can be integrated in teaching and learning to provide opportunities for learners to repeat and practice the learned content in order to realise the principles which are followed in the behaviourism as discussed below.

2.5.1.1   Basic assumptions of behaviourism regarding ICTs in the 21st century

Behaviourist teaching and learning is characterised by techniques and principles which distinguish it from other learning theories. The teacher using behaviourist theory knows what steps are to be followed in using ICTs in teaching the learners, the instructional objectives to be pursued, environmental factors to be manipulated to induce learning, the

assessment and changed behaviour which will satisfy the teacher. According to Ertmer and Newby (2013:49), the main principles of behaviourism are as follows:

- The child is a passive recipient whose behaviour is shaped by environmental factors.
- It is concerned with observable and measurable aspects of human behaviour.
- There is a stimulus such as drill and practice programs and tutorials and a predictable response that follows as a result thereof.
- Prediction of someone's behaviour in a particular situation by studying and manipulating the environmental conditions that influence behaviour.
- All behaviour is learned habits and accounts for how these habits are formed.
- Learner behaviour can be strengthened or weakened by introducing various kinds of reinforcements such as the immediate feedback.

2.5.1.2   Behaviourist view of teaching

From the behavioural point of view, teaching is an activity of the teacher and is a process of transmitting, transferring or conveying information to passive learners (Brown, 2006:110). Behaviourist learning theory maintains that the teacher's role is to teach; as such they are recognised as the subject expert, an authority and a primary source of knowledge for learners. As the central figure in the learning situation, the teacher also has the responsibility to determine what to teach the learners, what objectives are to be achieved, which steps are to be followed in conveying the content, and what reinforcements are to be used to endorse the learned behaviours.

Educational activities are executed from a teaching perspective and are focused on the strong points, preferences and teaching styles of the teacher. What will work best for the teacher determines the design of the learning environment and the nature of the activities. A teacher plans a teaching session based on what teaching methods they think would be best to transfer the relevant content to the learners. The teacher's role clearly indicates that learners are just 'black boxes' who are just there to record the information and practice

it until behaviour change is achieved according to the behaviourist objectives and standards. This view is further asserted by Dede (2008:55) in stating that many teachers are comfortable with face-to-face teaching or learning and their learners are expected to be similar in their learning styles.

2.5.1.3 Behaviourist view of learning

According to behaviourism, the teacher occupies a central space, knows what children need to learn, what objectives are to be achieved and transmits knowledge to the learners who are to accept it without questioning. In this situation the learner's feelings and intentions are disregarded and learners are also not allowed to express their opinions. The learner is therefore a passive recipient whose behaviour and actions are shaped and modified by environmental factors that are external to him (Dede, 2008:46; Ertmer and Newby, 2013:50). Consequently learning in this paradigm is accomplished when a proper response is demonstrated after a specific environmental-stimulus has been presented (Ertmer and Newby, 2013:51).

Although this kind of teacher-learner interaction has been criticised by the constructivists, the researcher considers it appropriate for small children who need to be directed in their scholastic activities and to gain mastery of basic skills through repetition, practice and memorisation of the facts so that they can succeed in executing the learned information. These basic skills are the prerequisites and the stepping stone to higher-order thinking skills as indicated by Altuna and Lareki (2015:4). An example that can be cited is the numeracy tables and the language structures which have to be learned and memorised.

The weakness of this paradigm is the mere transmission of information to passive recipients, while the learners' potential, their learning styles, their existing way of doing things are not taken into consideration and a big concern is the disregard for the inner processes of how learning occurs (Tupas and Pendon, 2016:394; AlDahdouh, Osório and Caires, 2015:14; Hung, 2001:281). Learners are regarded as being on the same development level hence they are taught what the teacher deems relevant for them all as a group. Knowledge is conveyed to the learners by the teacher using the textbook as a secondary source of information. The

change of behaviour of the learners implies that learning has occurred and knowledge has been acquired and retained by the learner. The desired response which is indicative of the learned behaviour is then rewarded in order for learning to take place (King, 2016:41). The positive response is the result that emanates from stimulus-response associations made by the learner. As the behaviourists maintain that all behaviours can be learnt, they also posit that when a behaviour becomes unacceptable, it can be unlearned and be replaced by an acceptable one. In our everyday situations this is illustrated by having underperforming learners repeat and practice what should be known in order to gain mastery of the content and to ascertain that learning has actually taken place. Various technologies such as games, tutorials and simulations are incorporated into behaviourist pedagogy to help achieve mastery of learning and those goals that are considered to be the cornerstones of this learning theory (Ertmer and Newby, 2013: 69).

2.5.1.4   Behaviourism and ICT integration in teaching and learning

Various technologies can be used in accordance with behaviourist techniques and strategies to transmit information and knowledge to learners in order for them to realise the instructional objectives. In an ICT resourced environment, different technological tools can serve as stimuli which engage the learner in a learning activity in order to acquire knowledge. Computer-Aided Instruction (CAI) based on behaviourist principles is still used to teach facts, information and skills associated with subject-related material (Dede, 2008:46). The CAI applications considered suitable for use in a behaviourist learning environment for the transfer of knowledge and skills include programs such as games, drill and practice, tutorials, simulations, educational games and problem-solving programs. In accordance with behaviourist procedures, these applications can engage the learner by providing activities which the learner must interact with until the desired response is demonstrated.

Drill and practice programs in numeracy as demonstrated in game technology on elementary learning in mathematics (Shin *et al.,* 2012:549-552) and languages are used to cultivate basics which are prerequisites for abstract learning and the development of higher-order thinking skills. According to Shin *et al.,* (2012:542) the game rules and goals play an

important role in supporting learner's cognitive development. Playing games is also essential in enhancing abstract thinking such as organising ideas with particular properties into groups or finding a pattern. Research findings (Cox, Webb, Abbott, Blakeley, Beauchamp and Rhodes, 2003:19) also confirm that simulations help in the acquisition of knowledge and the retention of facts.

The researcher in this study concurs with the effects of drill and practice programs, tutorials and simulations since they are tools or tutoring programs that provide interaction with learners and also enable learners to form good foundations for shaping quality learning. The various CAI applications are designed to stimulate learners to use critical thinking skills and creativity and they are an effective way to teach content through repetition and practice. In other words learners use technology to learn what is contained within the technology, what the technology knows (Siemens, 2004:3). The tools learners use serve as the tutor; they contain the subject content, the objectives which are to be achieved, and reinforcements which are used in the assessment. Learning is done at learners' own pace, and the immediate feedback and reinforcement which contribute in confirming the attainment of goals or successful learning are significant in developing the enthusiasm and the assurance of mastering the learning content.

In the context of this study the use of ICTs based on behaviourism is of great importance since the behaviourist procedures and principles are still used in the learning environment. Teachers still occupy the center stage and mainly use the lecture method in transmitting knowledge to their learners. The instructional objectives are assessed by means of the activities, tests and examinations that learners write. These performances are reinforced with the pass or failure remarks which endorse the learner's observable behaviour and performance. Most of the township primary schools in the researcher's study with access to ICT tools are teaching Computer Literacy which is one of the subjects of the CAPS curriculum. This is also characteristic of behaviourism which emphasises that learning is external to the learner.

The ICT is a tool that serves as a tutor which conveys the facts to the learner. The learner's interaction with the machine and the step-by-step instruction is controlled by the machine.

The learning process confirms Dede's (2008:46) assertion that learners who are taught through the behaviourist instructional approach are passive and their mental actions which play a part in ensuring that learning takes place are not taken into consideration. Secondary school teachers integrate ICTs in different subjects but their teaching is a conglomeration of various principles of the different learning theories available. The teacher's use of distinct features from all types of learning theories indicates that behaviourism alone is not sufficient in describing the learning phenomenon. The critique of the behaviourist learning theory will be outlined in the subsequent paragraph.

2.5.1.5   Critique of behaviourism in terms of ICT use in teaching and learning

Emphasis on reaction to stimuli and environmental factors which are ICT tools and machines used in inducing learning, lack of consideration for learner's prior knowledge and the lack of active participation has resulted in a shift away from behaviourism and led to the development of other learning theories that consider cognitive processes of storing and retrieving of information in the memory, attribution of meaning and knowledge construction (Brown, 2006:115; Hung, 2001:28; Ertmer and Newby, 2013:51). The subsequent constructivist learning theory puts more emphasis on productive learning in which learning is seen as a mental activity and what the learner can do with the acquired knowledge after the learning process has occurred.

Although behaviourism is one of the historical theories that explain how people learn, critics see learning according to this school of thought as a reaction to stimuli and other external forces which does not focus on the thinking process (von Glasersfeld, 2014:9; Ertmer and Newby, 2013:51). The learner's reaction is regarded as automatism and cannot adequately explain how information is stored and retrieved from memory. As all the mental functions relating to learning are disregarded, this led to the development of new learning theories which focus more on internal mental processes (AlDahdouh *et al*., 2015:14).

The behaviourist learning activities concentrate on studying and memorising. In the educational setting, the teacher transfers knowledge to the learners and they are assessed in terms of how well they can memorise and reproduce the learned content. Rote learning is

condemned as it does not prove that the learner has acquired knowledge with understanding. In spite of this criticism, the researcher agrees with Ertmer and Newby (2013:60) that when learning, people progress from a low-to-high knowledge continuum thus in the researcher's opinion the memorisation of basic skills in languages and mathematics is of significant importance and this equips learners to develop higher-order thinking skills necessary for learning at advanced levels. The significance of memorisation is confirmed by Hung (2001:284) who mentions that individual instructive tools such as the tutorials and drill and practice programs are good tools for supporting basic information and knowledge such as multiplication tables.

Emphasis on mastering content and the recall of facts led to behaviourism being criticised for not engaging activities that require learners to use critical and creative thinking skills. The acquisition and retrieval of information when needed, show that the focus of learning is on gaining knowledge rather than on the learner's potential and capabilities.

The behaviourist ideology regards the teacher as the primary source of information and accords the teacher an authoritative status (Brown, 2006:115). Consequently, teachers see themselves as being entrusted with the responsibility of filling children up with knowledge as if they are receptacles and knowledge is a product.

Behaviourist learning is highly mechanistic and fails to engage learners in more natural ways of learning that involve real life situations. According to Dede (2008:48), Ertmer and Newby (2013:55) behaviourism has been criticised for disregarding the learner's experiences, prior knowledge and learning style. It also ignores the mental processes of learning and only focuses on lower level knowledge acquisition.

Another criticism leveled at behaviourism is the practice of having learners react to ICT tools instead of using ICT tools to amplify the teaching and learning processes which enable learners to off-load the basic cognitive demands and engage in various higher domains of knowledge (Duffy and Cunningham, 2008:19). This makes the critical point that more should be done at schools rather than just the reproduction and recall of facts. This is where ICT

tools play a role in actuating interaction with the content and with fellow learners and engaging higher-order thinking skills.

These criticisms have led to the demise of behaviourism and constructivism emerged as the new learning theory that promised to explain all the aspects that were not catered for in behaviourism. Constructivism as the counter theory to behaviourism will be discussed in the subsequent section.

2.5.2   Constructivism

According to Ertmer and Newby (2013:55), the objectivistic nature and disregard for the mental activities in behaviourism saw this school of thought being shunned in favour of a theory that accounts for how learning occurs within the learner. Constructivism is the learning theory that developed as a counter reaction to behaviourism and, according to Vygotsky (1978:84) and Roberts and Potrac (2014:181), it emphasises the way that individuals, through their cultural background and the environment, acquire and develop their understanding and knowledge. The merits of this school of thought include interaction, meaning attribution and the construction of knowledge by individual learners or groups of learners. The constructivist trend in many countries and educational systems has been adopted as it emphasises the fact that learners and students should construct their own knowledge instead of knowledge being mapped onto the learners and filling them up with information, learners are provided with an opportunity to generate solutions to problems they encounter with minimal help from teachers (Roberts and Potrac, 2014:182; Ertmer and Newby, 2013:55; Duffy and Cunningham, 2008:11).

2.5.2.1   The strands and forms of constructivism

According to Roberts and Potrac (2014:181) and Brown (2006:115) constructivists such as Vygotsky (1978:84), von Glasersfeld (2014:9), Duffy and Cunningham (2008:2) and Jonassen (1991:10) believe that learning is an active process of construction rather than acquiring knowledge and the goal of instruction is to support that production rather than trying to transmit knowledge. Thus, constructivists make a distinction between cognitive and social

constructivism. Wang (2008:413), Brown (2006:119) and Felix (2005:92) define cognitive constructivism as the constructive activity of an individual as they try to make sense of the world. In the cognitive constructivist approach the focus is on the individual in the group, with the belief that cognition occurs in the head of the individual and learners make intellectual sense of the material on their own by means of using the cognitive tools also known as mind tools that engage and facilitate cognitive processes (Wang, 2008:413; Felix, 2005:86). It is believed that people interact with their environment and develop frameworks to explain their encounters and assist in negotiating future actions. This activity occurs in instances where teachers and those who are more knowledgeable mentor others in a problem-solving situation until the knowledge or skill is appropriated and mastered to ensure self-regulation and independency (Duffy and Cunningham, 2008:14).

Contrary to cognitive constructivists, social constructivists maintain that knowledge is not a mental activity only but it is viewed as an experienced relation of cultural and social processes which have a major role in actuating as well as influencing learning. Vygotsky (1978), the founder of socio-constructivism, emphasises the importance of the cultural and social context in learning by stating that higher cognitive functions in learners such as thinking and learning are embedded in a social interactional, cultural, institutional and historical context (Vygotsky, 1978:84). From Vygotsky's assertion it can be inferred that the external and environmental factors as well as the activities are of critical importance in igniting internal mental constructions and for the development of human cognition.

From the discussion above, the researcher's stance is that the two strands of constructivism are both important for the learning process in learners who have different learning potentials. The significance of social constructivism is that interaction with peers, parents, teachers and the use of technological tools can be of great importance in assisting learners to improve their mental functions and to construct knowledge.

This interaction is also important in assisting learners to achieve beyond their Zone of Proximal Development (ZPD) which is defined as the difference between what a learner can do without help and what he or she can do with help (Roustaee, Kadir and Asimiran, 2014:148) while Livingstone (2015:25) describes the ZPD as less advanced learners getting

assistance from an adult or more advanced learner to master concepts and ideas that pose a challenge to them. Social constructivism is relevant in this study due to the fact that teachers, unlike knowledge transmitters, must conduct teaching at the learner's ZPD while using learners' preferred learning styles as advocated by Shin *et al.*, (2012:452). The teacher's role of a facilitator or a coach who combines his or her teaching strategies with ICTs is commendable as this will encourage interaction, knowledge sharing and hands-on experience required in optimising the process of knowledge construction, the development of higher mental processes and collaboration which are in high demand in the global world.

2.5.2.2   Assumptions of constructivism

The constructivist teaching and learning principles are important in teaching and learning situations in order to ensure that teachers apply these methodological initiatives; and at the same time learners should participate in meaningful activities through using mental processes and collaboration. The assumptions that characterise constructivism will be discussed below.

The important epistemological assumption of cognitive constructivism is that knowledge is a function of how the individual creates meaning from his or her experiences and it is not a function of what someone else says is true (Felix, 2005:88; von Glasersfeld, 2014:9).

According to Dede (2012: 53-55), Shelly, Gunter and Gunter (2010:376), Chan (2006:4) and Felix (2005:92), constructivists agree that learners learn by doing through active participation. By participating in and interacting with the surrounding environment learners engage in creativity and use thinking skills that enable them to create a personal view of the world. By engaging in hands-on activities, learners engage in authentic, meaningful and contextual learning which eventually become personalised by learners.

In constructivist learning knowledge is constructed and not transmitted. With the use of constructivist tools learners engage in personal meaning making, discourse and the application of knowledge that has been collectively constructed with their fellow learners (Akpan and Beard, 2016:393). From this assertion it is apparent that teachers are not the

only source of information and their role is to facilitate learning to help learners optimise their skills. The teacher therefore assumes the role of a facilitator, a coach and motivator (Kler, 2014:267). Under the guidance of the facilitator, the learner is actively involved in creating his or her reality by understanding and attaching meaning to the learning context. However, it is important for the facilitator to complement the constructive approach with an instructive approach in instances where the learner needs to be told about the rules and foundational knowledge which are indispensable for creativity and learning using thinking and problem solving skills.

Another constructivist principle is that learners actively construct their own knowledge by anchoring new information to pre-existing knowledge. Akpan and Beard (2016:393), Chan (2006:6) and Izrik (2001:169) concur with this notion and posit that people learn best through their own experiences. This implies that we make interpretations of knowledge in terms of our own experiences. This is reiterated by social constructivism which proposes that prior knowledge, culture and the social relations also serve as sources of knowledge and scaffolding for the construction of new knowledge (Hung, 2001:283).

Learners have some control over the sequence and selection of content, the opportunity to actively construct their own knowledge representations, which can be applied to realistic tasks. Due to different learning styles and individual differences, learners have the liberty to learn at their own pace and are in control of their learning. Through the use of the web, learners are exposed to vast amounts of information and can choose what they want to learn. This is in line with lifelong learning which is recommended in the new era. Social constructivists (Vygotsky, 1978:90; Chan, 2006:6) assert that learning occurs within the context of dialogue and social interaction. By interacting with other people such as other children, parents and teachers, the child develops intellectually.

Another global requirement for efficient and effective learning in social constructivism implies cooperation and collaboration. Vygotsky (1978) recommends a social context wherein a more competent learner would be paired with a less competent one, so that the competent learner can elevate the competence of the struggling learner. Group work also implies that every group member has a role to play in accomplishing the task at hand.

The golden thread of collaborative learning is to help others to achieve according to the expected standards.

2.5.2.3   Teaching strategies associated with constructivism

The constructivist teaching techniques focus either on individual or social construction of knowledge and are geared to help learners to become knowledge constructors who will have the ability to identify, analyse, think critically about their own views and those of other learners and solve problems (Shelly *et al.*, 2010:379). Thus, the responsibility of constructivist teachers is to understand the cultural context and learning styles preferred by their learners in order to be able to create environments where learners are encouraged to learn and construct knowledge. The role of the constructivist teacher therefore is to facilitate the learning process because the teacher is one of the sources of knowledge (Dede, 2012:52; Wang, 2008; Brown, 2006:115).

As a facilitator, the constructivist teacher is there to guide and coach learners to inquire, explore, discover and generate new learning. Another responsibility for the constructivist teacher is to create opportunities for collaboration. Constructivist teaching requires learners to examine thinking and learning processes which embrace collecting, recording and analysing data; formulate and test hypotheses; reflection on previous understanding and construction of their own meaning. In this manner learners are enabled to make their own connections that result in valid internalised meanings to them (Akpan and Beard, 2016:394). In constructivist practice, the teacher's role is to provide a rich and stimulating environment that leads to interesting and exciting questions as indicated by Altuna and Lareki (2015:5). The teacher uses activities or instruction that involves extensive modeling, discussion and explanation.

However challenges associated with constructivist teaching include, among others, the lack of clear guidelines for learners on how to approach learning activities; the sheer volume of information on the internet which may confuse learners; and the possible disadvantage to below-average and shy learners who are more passive and inactive in comparison with smarter learners who take the lead in group activities.

2.5.2.4   Learning strategies associated with constructivism

The teacher's responsibility in a constructivist learning setting is to model knowledge production which kindles a desire in the learners to construct their own knowledge based on their understanding. According to Vygotsky (1978:90), learning happens in learners' ZPD, under adult guidance or in collaboration with more capable peers. Thus, active learning in constructivism is not about listening and then mirroring the correct view of the world, but participating in and interacting with the surrounding environment in order to be able to create a personal view of the world. The learner is therefore seen as an active thinker who constructs his or her own knowledge by working with objects and ideas (Roustaee *et al.*, 2014:147; Allahyar and Nazari, 2012:82).

Learning conducted according to constructivist principles allows learners to tap into resources and acquire knowledge rather than force them to function as recipients of instruction (Wang, 2008:413; Felix, 2005:88). The focus of teaching concentrates on guiding the learners as they build on and modify their existing mental models, which means the construction of knowledge rather than the transmission of knowledge. The constructivist approach to active learning, as well as the participation in and interaction with the surrounding social environment, enables learners to function as a part of a community of practitioners helping to solve real world problems. Due to the practical nature of constructivism, the approach is regarded by many educational thinkers as a suitable framework for the learning environment of the future. This includes the context in which ICTs form an essential part of teaching and learning which will be discussed next.

2.5.2.5   Constructivism and the use of ICTs

Contrary to the learning content embedded in technological tools ready to be transferred to passive learners, constructivism describes the role of ICTs which include resources, such as computers, the internet, smart cellular phones and the interactive dictionary, as learning with technology. Learning with ICTs implies interacting with the tools, necessitating the engagement of creativity, higher-order thinking skills and problem solving in the act of learning (Dema and Moeller, 2012:76). Interactivity is a major construct and a striking

characteristic of an ICT learning environment. ICTs are essentially aligned with constructivism, where the emphasis is on individual learners constructing their own truths in new learning models from the interactive lessons (Sekgwelea, 2007:18). This view is reinforced by McLoughlin and Lee (2008:643) who assert that the affordances of ICTs such as web surfing, email and the internet create a terrain for networked, collaborative and social learning so that collective intelligence can be used to generate richer and sophisticated ideas.

Based on the social constructivist theory, the online learning environment provides a safe and comfortable space in which learners share information. Blogs, wikis and e-mails are opportunities that learners can use to discuss, share and disseminate information. These tools also afford learners the chance to work together on common goals, exchange opinions, clarify meanings or jointly address a problem (Rae, Roberts and Taylor, 2006:521). The significance of using ICTs for communication and collaboration among learners is confirmed by Wang (2008:413) who maintains that the internet is the ICT tool that is used by learners for scholastic and social purposes. The internet is also used to search for and access information, to send emails and to contact other people such as experts other than parents and teachers. The possession of smart mobile phones enable South African learners to access the internet, send messages, chat with friends and help one another or to learn from each other (Osman *et al.*, 2010:12). Osman *et al.*, (2010:12) also mention that the functionalities of mobile technologies enable learners to engage in learning activities or communication anytime and anywhere, and this has resulted in making them popular among the learners.

According to Cavas *et al.* (2009:21), the use of ICTs in constructive teaching and learning increases motivation and confidence, and captures the attention and interest of the learners. The use of digital media affords learners the opportunity to use newly acquired knowledge successfully in simulated situations. In a constructivist learning environment, computer networks or rather computer-mediated communication (CMC) is used to facilitate interaction between spatially separated learners by means of electronic mail, computer conferencing and online databases. Through these technologies groups can work together to solve problems, argue, negotiate meaning or engage in other pedagogical activities

including coaching, modeling and scaffolding of performance (Dema and Moeller, 2012:76. Such engagement contributes to developing learners into knowledge producers because today's learners perceive little value in the absorption or rote learning of factual information, given the accessibility and ease of use of search engines and web-based reference sites.

The knowledge construction paradigm is appropriately applied to learning environments where ICTs and digital tools and affordances enable engagement in self-directed activities and learners have the freedom and choice to move beyond mere participation in communities of inquiry to become active creators of ideas, resources and knowledge artifacts. The computer-supported collaborated learning provides tools to facilitate learning. The provision of help from the teacher, peers and ICT tools fulfill the scaffolding role.

In the literature reviewed (Tay *et al.*, 2012:742), it is indicated that various ICT applications are used in direct instruction situations to generate and support the learning of basic information skills, whereas informative tools such as the internet are employed in a social constructivist environment to provide the resources and material required to enable the interactants to construct their own knowledge. The resources make it possible for learners to communicate with each other in the social media arena. Consequently the use of ICTs for constructivist outcomes has reconfigured the traditional learning landscape to provide learner-centred and the just-in-time pedagogy as proposed by Osman *et al.*, (2010:15).

In addition to these characteristics, the learning activities emphasise construction and discovery of knowledge, learning tasks focus on independent learning and provide opportunities to foster deeper understanding. Learning is aimed at ensuring that all learners learn effectively and efficiently (Tedla, 2012:204; Mdlongwa, 2012:5). The new trends in the ICT field, its development, the knowledge available, the accessibility by anyone, anywhere at any time reveal some weaknesses in the constructivist approach. The loopholes of this paradigm will be dealt with in the next section.

2.5.2.6 Critique on constructivism

While the constructivist position emphasises the value of ICTs in the discovery of information and knowledge construction both in the classroom and elsewhere, and the importance of accessibility to the internet, the theory does not provide theoretical foundations for learning. Rapid technological inventions and the large body of information available provide the basis for criticism of constructivism and call for a paradigm shift that is relevant to the knowledge era (Brown, 2006:111). Siemens (2008:1) goes further, stating that existing learning theories have failed to meet the needs of the 21st century learner. The criticisms and concerns leveled against constructivism will be examined in further detail.

Critics of the constructivist paradigm state that constructivism is a theory of knowledge that emphasises knowledge rather than a theory of learning which explains how the learning process occurs (Brown, 2006:115; Osborne, 1993:3). Collaborative learning is one of the cornerstones of constructivism. However, critics (Felix, 2005:88) maintain that the root of the problem and a big challenge in terms of cooperative learning and collaboration, is that there is often tension between the individual and the collective rationality. A decision that is reasonable and justifiable for the individual can lead to a poorer outcome for all. On the other hand, the decision of a group may not be appreciated by individuals. The constructivists on the other hand focus on the construction of knowledge through internal and social negotiation but do not provide a mechanism for learners to use to create new knowledge as posited by Izrik (2001:170). In such settings it is impossible to predetermine and prescribe a sequence of teaching and learning activities.

Another point that needs to be highlighted is that learners have different potential and different learning styles. As a result not all learners are at ease with the constructivist model and principles. According to Felix (2005:90), some learners still need guidance and frequent reinforcement from the teacher. These concerns as well as the development of new trends, the invention and the proliferation of new ICTs, the massive body of information available to anyone in the world, and the manner of sharing and distributing knowledge to effect learning, have prompted a paradigm shift away from constructivism to another learning

ideology which accommodates the above mentioned characteristics. This new paradigm will be discussed in the next section.

2.5.3   Connectivism: a learning theory for the digital age

The third millennium is an era characterised by a changing world, new technologies and a large body of information which is available to learners through collective blogs within teaching and learning irrespective of geographical boundaries and time zones (Garcia, Brown and Elbeltagi, 2013:253). Connectivism is regarded as the relevant learning theory for the digital era which still accommodates learning objectives and knowledge construction (Downes, 2008:1; Siemens, 2004:4). In this learning theory, learners form connections with the information flow between the learner and the network members. Through this interaction, Garcia *et al*., (2013:254) maintain that learning occurs as peers collaborate, share opinions and critique each other by means of dialogue.

According to Siemens (2004), the founder of the theory, connectivism indicates how learners utilise the knowledge gained through a personal network. Although connectivism is the latest learning theory compared to the established ones earlier discussed in this chapter, it disregards the older learning theories and plays a major part in explaining the new developments which are not catered for by the older theories. Connectivism builds on principles of known learning theories such as perceiving knowledge as transmitted facts, the need for unique cognitive skills to process information successfully, and collaboration in distributing the information (Bell, 2011:3) but it puts more emphasis on the creation of networks for connection and access to current knowledge. The importance of this theory is its relevance due to its socio-technological nature which allows teachers and learners to connect and form networks of learning communities and platforms for accessing, interaction, sharing, thinking and distributing current knowledge (Kop and Hill, 2008:1).

Connectivism as a learning theory for the digital age has an impact on teaching and learning since ICTs provide the social media for networking and information distribution to all network members in order to gain knowledge. The relevance of connectivism in this study is that teachers and learners should establish networks and nodes for knowledge acquisition

and sharing in real time, to empower themselves and their peers. From the teaching point of view, teachers share and interact with peers to improve their knowledge of the subjects they teach and get ideas on how to improve their teaching techniques. These attributes are due to the complex nature of connectivism and are key principles that characterise connectivism as a learning theory which should be reckoned with by teachers. The principles that underlie connectivism are highlighted in the next paragraph.

2.5.3.1   The principles of connectivism

Just like the older learning theories, connectivism explains how the learning process occurs and how it can be enhanced in an ICT environment. The nature of having network members from all over the world getting information from various sources implies that in connectivism, learning and knowledge rest in a diversity of opinions. As the latest learning theory dealt with in this study, some of its assumptions originate from the former theories. Just as behaviourism emphasised the importance of external factors to actuate learning, connectivism also states that learning resides in non-human appliances. According to Bartolomé and Steffens (2015: 96), learning is a process of connecting specialised nodes or information sources such as people, organisations, libraries, websites and data bases. In the researcher's opinion these nodes are essential entities and can be used by teachers to gain up-to date information for their enrichment and professional development especially where the in-service training of teachers is inadequate due to fiscal challenges.

The use of these information sources by teachers is critical in the South African context where teachers' unions, such as South African Democratic Teachers' Union (SADTU) and National Professional Teachers' Organisation of South Africa (NAPTOSA), are associations which manipulate the events and the behaviour of teachers, sometimes jeopardising the implementation of the education policy and boycotting policy monitoring and accountability (De Clerq, 2013:45). By participating in online communities of learning, teachers can be empowered with the information and knowledge they require to be successful in their careers. Learners can be empowered to engage in self-directed learning in which they are required to adjust their learning actions and achieve set goals.

The ability of ICTs to transcend geographical boundaries and allow information flow increases the capacity to know more than what is currently known. As a result connections need to be nurtured and maintained to facilitate continual learning. Online learning requires network members to have the ability to see connections between fields, ideas and concepts as a core skill (Livingstone, 2015:29; Bell, 2010:5). Another skill required from network members is the ability to identify accurate, up-to-date knowledge in connectivist learning activities. Decision-making itself is a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to new developments in the information climate affecting any decision (Davis, Edmunds and Kelly-Bateman, 2008:2). It is the researcher's impression that the mass of information as well as the currency of information are some of the conditions that pose difficulties in a connectivist teaching environment. This aspect will be discussed next.

2.5.3.2   Teaching in a connected environment

Teachers in an educational environment are confronted with the problem of having an overwhelming amount of information streaming from the network and they also need to be vigilant about the currency and the truthfulness of information as it can be changed by the new information being posted and shared on network platforms. The other concern that teachers face is to know what exactly should be taught due to the massive amount of information on the web applications. eLearning advocates assert that by being connected with the Community of Learning (CoL), teachers are provided with opportunities for teaching, learning and sharing knowledge with people who have the same interests anytime and anywhere (Wang, 2008:415; Kop and Hill, 2008:6; Yahya, Ahmad and Jalil, 2010:119). These interactions result in a learning process which is greatly influenced by cognitive, affective and emotional factors. The networks that people establish are significant for providing the expertise, knowledge and guidance that is needed by various network members.

Due to online information and tutoring, Kop and Hill (2008:6) maintain that in the connectivist environment, teachers may no longer be needed. This is attributed to the fact

that learners can be in a learning environment where they choose what they want to learn and be responsible for directing their own learning. Finding their own information and the creation of knowledge by engaging in networks away from the formal educational setting is another factor that may result in teachers not being needed to facilitate learning. However, the presence of teachers is necessary to provide guidance to learners in choosing what they want to learn and also how to construct their own knowledge.

2.5.3.3   Learning in a connectivist context

Research findings reported by Isling Poromaa (2013:656), Ferrari, Cachia and Punie (2009:363), Tedla (2012:200) and Starkey (2011:24) indicate that in an ICT teaching and learning situation, teachers' ICT competencies and attitudes determine the successful use of ICTs in the classroom. This assertion confirms that teachers are indeed in control and central figures in ensuring that ICTs are integrated in the teaching and learning situation. Teachers are still important in the connectivist environment to guide learners with regards to what content learners need.

Although learning at global platforms is acceptable for social development, the researcher of this study finds that it may constitute a problem since learning information developed in foreign cultures may conflict with local material and beliefs. Despite cultural differences in learning, connectivism occurs through the use of both the cognitive and affective domains as cognition and emotions contribute to the learning act in significant ways. This is indicated by the cycles of forethought, execution and volitional control and self-reflection which address motivational and behavioural characteristics to achieve set educational goals (Bartolomé and Steffens, 2015:96). Learners, not the teacher or institution, will be at the center of the learning experience. Consequently, learners will be instrumental in determining the content of the learning in addition to deciding the nature and levels of communication and who can participate (Kop and Hill, 2008:6).

The learning process is influenced by the diversity of networks and transfer occurs through the process of connecting. In furtherance, the learning process is cyclical in that learners connect to a network to share and find new information, modify their beliefs on the basis of

new learning, and then connect to a network to share these realisations and find new information once more (Ertmer and Newby, 2013:66; Kop and Hill, 2008:2). McLoughlin and Lee (2008:644) see the learning process in connectivism as characterised by connecting information sets and by helping learners to see the connection between events and ideas. Since knowledge rests in a diversity of opinions, learning is therefore a process of connecting specialised nodes or information sources (Siemens, 2008:2).

Connectivism stresses that the two important skills contributing to learning are the ability to seek out current information and the ability to filter secondary and extraneous information. Learners need assistance in executing these skills but the online learning environment and diverse cultures make it difficult for a teacher or a facilitator to coach the learner. Despite indications that connectivism assures global learning online, there are concerns about it as a learning theory, which will be discussed next.

2.5.3.4   Critique on connectivism as a learning theory

Given the volume of information available on the internet, the need for guidance when it comes to searching for current information and filtering out extraneous material becomes an important factor in the ICT environment. Learners need teachers to monitor and guide their progress. Online teaching and learning without a local teacher, and the abundance of available information on the internet are some of the criticisms directed at the connectivist approach. A fundamental criticism of connectivism articulated by critics such as Verhagen (2006:1), Bell (2011:8) and Duke *et al*., (2013:10) is that connectivism is a pedagogical view and a tool used in the learning process, but cannot be considered a learning theory.

According to Bell (2011:8), connectivism is viewed as a phenomenon that serves to inspire teachers and learners to make changes to their activities. Kerr (2006:1) highlights three main facets that characterise a good learning theory: a good learning theory should contribute to theory; it should provide a significant new perspective on how learning occurs; and represent historical alternatives accurately. This is not the case with connectivism as it does not explain how learning actually happens and as a result it misrepresents the current state of established alternative learning theories such as behaviourism and constructivism.

Although connectivism disregards former learning theories, it subscribes to the Vygotskyan theory because there is an element of informal learning in a digitally mediated setting as well as the use of the ZPD, where help and the expertise and ideas of capable people are needed to empower learners.

Connectivism is also criticised as a learning theory that replaces behaviourism and constructivism. The replacement claim is challenged because connectivism does not add to the principles of the existing theories. Verhagen (2006:1) places connectivism at the level of curriculum as opposed to theory, simply because it speaks to what people should learn and the skills they should develop. At a curriculum level it is seen to be contributing to the development of new pedagogies where control is shifting from the teacher to the more autonomous learners, reminiscent of the constructivist shift identified by networked learning. Verhagen (2006:4) further maintains that in the connectivist theory people still learn in the same way, although they adapt to the changing technological landscape.

Verhagen (2006:4) maintains that using knowledge that is stored in "non-human appliances such as books, journals and libraries" is something that has been done through the ages and memory limitations have been compensated by writing notes or writing things down, printing books and creating databases and modern cognitive tools are an extension of the toolkit. Connectivism lacks an extensive body of empirical research literature to let it qualify as a theory that describes the learning phenomenon. This is substantiated by Kop and Hill (2008:4) who emphasise the importance of observing a phenomenon over a period of time and eventually developing a theory for the explanation.

The researcher's view is that the use of networks such as discussion forums and online learning serve the purpose of teaching users who lack particular knowledge or those individuals who do not have the opportunity to attend educational institutions (Livingstone, 2015:28). These platforms empower users with most needed knowledge, techniques to execute tasks, collaboration to achieve common goals and distribute information to ensure that everybody benefits. This explains how network members learn and is the major aim of any learning theory.

Despite the lack of intensive research and observation, connectivism can therefore be regarded as a learning theory. One of the key tenets of connectivism is that knowledge resides in a distributed manner across networks. It assumes that learning environments for all institutions and all learners are furnished with the kind of technology required for the connectivist learning activities of forming diverse networks on connections, communication, sharing and collaborating with one another. This assumption is not true for schools in poor and underdeveloped countries as indicated by Dzansi and Amedzo (2014:345), Tella, Tella, Toyobo, Adika and Adeyinka (2007;10) and Moll and Ndlovu (2010:142) who point to the lack of internet access and poor ICT competencies in many Nigerian and South African township and rural schools. Moreover, research studies on ICTs in South African schools highlight the lack of ICT infrastructure, poor or lack of training, insufficient support, lack of communication, low levels of confidence and proficiency and lack of network literacy as some of the barriers that inhibit ICT integration in education (Mlitwa and Koranteng, 2013:9).

Despite the critique of connectivism as a learning theory, the researcher's contention is that there are grounds for considering connectivism as a learning theory and valid points situate connectivism at a pedagogical level. Firstly, as a learning theory, the individual learner uses the network to acquire information and uses his or her discretion on what knowledge to select. The learner decides on how the acquired knowledge is used to empower himself or herself. This is in line with the constructivist principles of active participation, collaboration, meaning attribution, decision making and knowledge creation in the learners' right. Lack of sufficient testing, observation over a considerable period of time and insufficient data to provide a basis for a learning theory compels the researcher of this study to regard connectivism as a means to enhance the behaviourist and constructivist modes of learning. Due to the researcher's belief in the potential of ICTs to improve the quality of teaching and learning, the stance of connectivism as a learning theory should be taken into consideration given the connections created to facilitate the learning process to acquire, share and distribute knowledge.

In spite of the criticisms highlighted above, connectivism is currently the most appropriate learning theory to explain the educational use of ICTs in the network society characterised

by loads of information, new technologies and changes in human behaviour. The societal changes and the creation of networks for the distribution of knowledge do not imply the eradication of the former learning theories since connectivism derives its principles and techniques from existing disciplines and established learning theories.

2.6   A SUITABLE LEARNING THEORY IN TERMS OF ICTS IN THE 21ST CENTURY

In scrutinising the various learning theories, it is evident that there is a relationship between behaviourism, constructivism and connectivism. The subsequent learning theories actually improve on rather than replace the former ones. Consequently all learning theories identified in this study are significant theories which can be applied when integrating ICTs in teaching and learning. The question that arises is: *Is it necessary to have one learning theory in an ICT learning situation?*

From the discussion of three learning theories, it is clear that constructivism was conceived after behaviourism, and connectivism came after constructivism. The sequence of these learning theories does not mean that the most recent learning theory is the best of the three paradigms. Altuna and Lareki (2015:16), Davis *et al.,* (2008:1), Brown (2006:115), Ertmer and Newby (2013:60, 69) as well as Dede (2008:57) are clearly of the opinion that all learning theories are relevant as various ICT tools, teachers' beliefs, the learning content and the context play a major role in determining which principles need to be applied to a particular learning environment.

Previous research (Kop, 2011:9) indicates that, in the connectivist learning context, constructivist principles need to be included to ensure that effective learning takes place. This assertion is illustrated by Kop (2011:9), who states that the social presence of facilitators and the support from experts is of utmost importance. The same sentiment is posited by Chigona and Chigona (2010:3) where they advocate a blend of instruction and construction be employed in the ICT mediated learning environment in order to balance the approaches. The researcher of this study concurs that the principles of constructivism and behaviourism are currently being followed and used in teaching and learning with ICT. The presence of teachers is essential for guiding learners, organising learning projects and

ensuring learners have successfully learned their material through assessment measures. From this statement it is evident that all learning theories are important and can be used at the same time depending on the task at hand.

Although there is a chronological order to the three learning theories, the researcher does not agree that one learning theory supersedes the other. The researcher also contends that former learning theories do not become obsolete but are still important in explaining the 21st century learning situation. The context, circumstances, learning content and the learners determine the learning principles to be applied and an astute teacher can apply principles of all learning theories (AIDahdouh *et al*., 2015:14). AIDahdouh *et al*., (2015:14) further illustrate that as a result, teaching and learning in the present era are still based on behaviourist foundations. Some learners in the constructivist environment need the teacher's explanations and clarifications. Therefore the researcher of this study is of the opinion that all three learning theories build on one another to provide a rounded theoretical toolset for the modern teacher to exploit in an ICT teaching and learning environment.

This discussion of learning theories clearly demonstrates the dynamic nature of education and learning theory, as the significance of one historical learning theory declines, a new theory comes to be highly regarded. This indicates that nothing is static and a new thesis breeds an antithesis, and like other learning theories, constructivism has its shortcomings. The prominence of ICTs, the knowledge society and the 21st century requirements are some of the aspects that led to the establishment of a learning theory which accommodates the use of ICTs in teaching and learning.

The progression of theories can be illustrated with the adapted representation below:
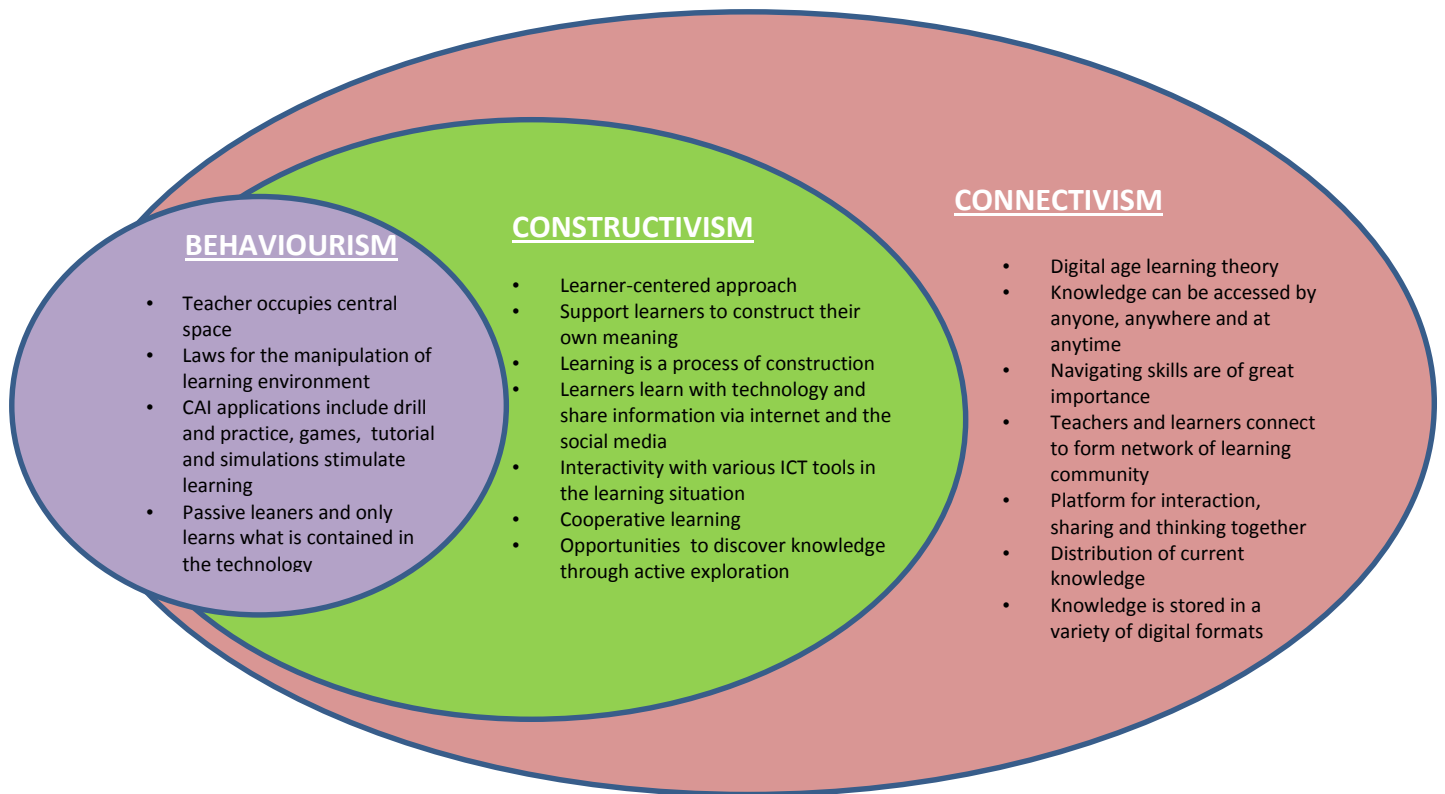
Figure 2.1: The progression of learning theories as adapted from Jay Cross' discussion blog.

While the three theories of learning differ in their principles, they all focus on the learning process and the attainment of educational goals. A comparison of behaviourism, constructivism and connectivism in terms of learning, teaching, ICT integration and critique of each learning theory are summarised in Table 2.1.

Table 2.1: Summary of the main learning theories

	BEHAVIOURISM	CONSTRUCTIVISM	CONNECTIVISM
Learning	• Learning is an act that must be observable and measurable Environmental factors determine what should be taught	• Learning is a process in which the learner is actively involved in constructing knowledge • Learner-centred approach	• Learning is a shared process and it happens by being member of the group, by collaborating and being actively involved

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	• The learner is conditioned by stimulus • The learner is a passive recipient of information • Prediction of human behaviour • Behaviour can be strengthened or weakened • Change of behaviour • Repeat and practice learned content • Automatic performance of specified procedures	• Learner's culture, background and experience are important in knowledge construction • The learner attaches meaning to the learning context • Learning is self-directed • Learners are guided as they build and modify their existing mental model	• Learning is a group activity • Unique cognitive skills required to process information • Learning occurs through the use of cognitive and affective domains • Learning is influenced by the diversity of networks • Transfer occurs through the process of connecting
Teaching	• Teaching is the activity of the teacher hence teacher-centred approach • Teacher determines what to teach and the objectives to be achieved • Drill and practice • Positive and negative reinforcements	• Teaching is a process of supporting knowledge construction rather than transmitting information • Teacher's role is that of a facilitator • Teaching focus on the construction of knowledge • Teacher engages activities which involve modeling, discussion and explanation • The teacher provides	• Teachers offer guidance regarding what is to be learned • Teacher is not a central figure but a co-learner

		environments that engage authentic activities • Teacher encourages higher-order thinking skills • Scaffolding of learners to be able to master certain skills	
ICT integration	• CAI applications: drill and practice, tutorials, educational games • ICT applications are used to support the learning of basic skills • Immediate feedback is used to reinforce behaviour and to support learner in achieving the learning outcomes	• Learners interact with ICT tools • Communication and collaboration among learners irrespective of their locations • ICTs increase motivation and confidence	• ICT enable the formation of networks and forums • Use internet to access, search, share and distribute current information • Social media are the forums for discussions
Critique	• Reaction to stimuli and environmental factors • Lack of consideration for prior knowledge • Lack of active participation • Memorisation without understanding • Less emphasis on cognitive functions	• It does not provide theoretical foundations for all kinds of learning in various settings • Theory of knowledge rather than a theory of learning • Learners have different potentials. Some learners need guidance and frequent reinforcers from the teacher.	• Teaching and learning happens on line and no local teacher is needed • Connectivism is not a theory because it does not add to the principles of the existing learning theories • Using knowledge stored in non-human appliances is not peculiar to connectivism

		• Knowledge explosion can confuse learners	

Besides the learning theories explored above, there are some social theories that endorse the use of ICTs in education since schools are microcosms of the larger society. The proponents of these social theories maintain that as new ICTs are employed in all spheres of life, national governments and the global village require human capital to be efficient and proficient in using ICTs in their different responsibilities which are aimed at personal growth and economic development. The network society theory which emphasises the use and the integration of ICTs in education will be explored next.

2.7   THE NETWORK SOCIETY THEORY

Network Society Theory is a social theory that focuses on social organisation and ICTs and the role they play in transforming teaching and learning in the schooling system (Wildemeersch and Jütte, 2016:2). The advocates of the network society, such as Castells (1999:1) maintain that the new social organisation originated towards the end of the 20th century as a result of the information technology revolution and the use of ICTs in all spheres of life. Network society theory emphasises the importance of knowledge and highly educated individuals if individuals, organisations and nations at large are to prosper. Based on the foundations of constructivism and network theory, connectivism was developed as the learning theory for the digital era. As the proponents of connectivism, Siemens (2004:3) and Downes (2008:1) highlight the necessity of learning through digital means and establishing connections to construct, critique and share knowledge which is one of the cornerstones of the knowledge society (Garcia *et al.*, 2013:254). Another important facet of connectivism is aimed at supporting innovation and lifelong learning for all network members (Redecker, Ala-Mutka and Punie, 2010:8).

Network theories endorse the formation of network communities and platforms, and use ICTs to acquire, share and distribute knowledge to everybody all over the world. Availability of knowledge to anyone, anywhere and at any time is confirmed by Selwyn (2012:87) with his notion of ICT development and the different routes that lead to different technological

outcomes, and Levinsen (2011) who asserts that communities are no longer limited to neighbourhoods because social networks provide ways in which people can use these new ties to access resources. As indicated by Castells (2000:350), these networks ensure the social inclusion of people into global networks for the accumulation and the flow of information. The same notion is referred to by Siemens (2008:6) who maintains that ICTs in network forums are the means through which knowledge is distributed for addressing various, complex challenges.

The network society theory is relevant to this study because the effective use of network platforms results in the professional development of teachers who have to engage in digital literacy and lifelong learning in order to produce self-motivated and self-directed learners. According to Levinsen (2011:53), these are learners who engage in constructive learning processes and are expected to encounter new things, ask questions, figure out the unknown and find it natural to network and share knowledge. As present day learners are digital natives, South African learners are also viewed as such. Research indicates that many teenagers in Gauteng province are addicted to cell phones and use them to access the internet, to download music, build their relationships and boost their self-esteem (Unisa, 2012:2-3). Other findings indicate that many South African learners especially in the high schools and institutions of higher learning use mobile technology for communication with their fellow learners and teachers (Mayisela, 2013:17). Consequently South African teachers have to be able to adapt to new conditions and challenges and employ ICTs to facilitate learning activities that will produce self-initiated learners equipped with the constructivist competencies required in the network society to be globally competitive.

The researcher finds such networks helpful in engaging teachers in discussions with colleagues and empowering each other when facing challenges in the teaching and learning milieu. These interactions help in allaying the fears that most teachers have regarding the integration of ICTs in teaching and learning. The theory used to underpin this study is network society theory which focuses on the integration of ICTs into social networks to acquire, share and distribute knowledge in order to create a knowledge society which will be able to use ICTs effectively to compete on the global market for social and economic

growth. Castells' (2007) network society theory is of great importance to ICT in education and to this study in particular and will be discussed in the subsequent section.

2.7.1 Castells' network society theory

Castells' (2007) network society theory emphasises the new social structure and ICTs which are an inextricable part of it. These ICTs are vehicles used to transfer knowledge in order to empower people with skills for personal, social and economic growth. According to Castells (2007), knowledge is associated with power and wealth enabling individuals and nations to be equal actors in the global arena. This is further confirmed by Butcher (2011:13) who states that knowledge is one of the pillars essential for the realisation of the knowledge-based society by producing learners and citizens with high order skills who know how to participate in a globalised community. The role of ICTs, especially the internet is therefore meant to disseminate knowledge, information and power in order to make people knowledgeable and better human beings and to make the world they live in a better place. Livingstone (2012:11) and Redecker *et al*. (2010:7) concur and state that the internet in the information society enables the widespread sharing of valuable resources, affording the means for collaborative learning and motivating learners in their learning.

Castells and Cardoso (2005:4) and Levinsen (2011:52) argue that in order for society to survive in the network society, it must have a self-directed labour force of highly educated people who are creative, problem solvers, critical thinkers, leaders, knowledge constructors and collaborators. These are the knowledgeable and digitally competent people who will be responsible for expanding the economies of their respective countries.

From this assertion it can be inferred that the various countries with educational systems that subscribe to the network society theory are obliged to develop curricula that focus on education that produces self-directed learners. Mdlongwa (2012:4), Chigona and Chigona (2010:2) agree with Levinsen (2011:52) and Castells and Cardoso (2005:4) on the participants required in a knowledge-based society and describe them as individuals with core competencies of self-direction, problem solving, critical inquiry, creativity, team work and communication and research skills which are highly valued in the modern workforce.

2.7.2   The network society and ICT in teaching and learning

Levinsen (2011:52) states that due to the global need for competitiveness and economic growth, the corporate world is inclined to recruit a highly self-directed workforce and lifelong learners for jobs that are network related. This calls for the integration of digital resources and teaching-learning theories to produce creative, critical thinkers, problem solvers, collaborative workers and ICT skilled learners who will be able to perform the future jobs. The implication for the schooling system is that schools can no longer be responsible for the transmission of prescribed knowledge but need to change and respond to the complexity of society, globalisation and the need for quality education (Tedla, 2012:199; Aktaruzzaman *et al*., 2011:114; McLoughlin and Lee, 2008:641). Schools are therefore required to employ ICTs to improve and enhance teaching and learning.

The network society requires teachers to be lifelong learners and use ICT to enhance teaching skills and their professional development. Levinsen (2011:52) states that teachers in the 21st century must have the ability to retrain, adapt to new conditions and cope with change and challenges especially in their main task which requires them to produce digitally literate self-directed learners. This indicates that teachers must develop a positive attitude towards educational innovation and to the use of ICTs in the schooling system. This requires them to understand the nature of their learners and the manner in which they learn.

The acceptance of ICT innovation implies that teachers have to adapt their familiar teaching methods but it does not mean that they must abandon what works according to their experience and their leading position in the classrooms. Such engagement is essential in developing the knowledge in teachers to enable learners to acquire skills recognised in the 21st century (Saavedra and Opfer 2012:10). With reference to learning, learners are expected to be active participators effectively engaged in constructing knowledge.

The pedagogical activities are in accordance with constructivist practices which engage learners actively in constructing knowledge. Since learning occurs in relation to others and other learning resources, the "new" learner-centred pedagogy involves engaging learners in apprenticeships for different kinds of knowledge practices, new processes of inquiry,

dialogue and connectivity. These characteristics put more emphasis on learning to learn rather than memorising information without understanding.

As illustrated by the network theory, learners and teachers interact with ICTs as actors in teaching and learning on the basis of the meanings they have for them. Through interaction and interplay with technological objects, learners are able to access, acquire and become proficient in the construction of meaning and knowledge development. Therefore the integration of ICTs in teaching and learning has the following constructivist implications for learners and teachers:

- Digital competencies that focus on creativity and performance;
- Strategies for meta-learning, including learner-designed learning;
- Inductive and creative modes and collaborative knowledge building;
- Learner-driven content, creation and contribution to communities of learning through social tagging, collaborative editing and peer review (Levinsen, 2011:53; McLoughlin and Lee, 2008:643).

The foregoing discussion focused on the relationship between knowledge and ICT as well as ICT implications for teaching and learning in the networked societies. However, the theory is marred by criticisms which are outlined in the next paragraph.

2.7.3   Critique of the network society in terms of ICT usage in schools

Although network theory focuses on learning using ICTs and various strategies to acquire knowledge in order to empower the members of society, there are factors which inhibit the development of the network society. These factors are principally poverty-related issues that render network use impossible for some nations.

Since the mode of development in a network society is technological and depends on knowledgeable individuals for social and economic growth, the notion of the network society is difficult to achieve in developing and third world countries due to poverty and lack

of access to new technological tools. According to Mooketsi and Chigona (2014:4), the South African society is stratified and divided and although the post-apartheid South African government consists of affluent societal members who have the means to acquire and access ICTs, there are many others who live in dire poverty and lack the means to acquire or to access ICT equipment.

As indicated by Mlitwa and Koranteng (2013:8), most schools in rural areas do not have electricity and have no computer infrastructure. Those that happen to have one or two computers are using those gadgets for administrative purposes and not for educational gains. Teachers lack skills, confidence and are technophobic. Some urban schools which are resourced with the ICT infrastructure are not teaching learners to use computers and other available ICTs. This is evidenced by Moll and Ndlovu (2010:145) who found that one of the schools identified for their research purposes uses a fully-fledged computer lab as an ordinary classroom and the teacher's lessons do not integrate ICT at all.

In addition, there is also a language barrier. Mdlongwa (2012:4) and Berry (2008:2) describe globalisation as being inseparable from the English language and the epistemological and cultural values inscribed therein, to the detriment of other linguistic and cultural traditions and the ways of knowing that they embody. The language used in ICTs pose an obstacle to any other country which has languages other than English as their first language. Internet content is in English and educational ICT provision is facilitated by agencies that subscribe to the importance of English and Western literacy.

The access and use of ICTs is defined as empowering and democratic since technology is considered one of the greatest enablers for improved quality of life. However, the majority of African teachers and learners are unable to realise the status of being powerful due to lack of ICT tools, lack of connectivity, lack of funds, inadequate ICT skills and lack of software in local languages. These inadequacies widen the digital divide and without internet connectivity, those schools will never get the chance to connect and participate in the global social networks and CoL established to disseminate and share information required for social and economic growth (Tedla, 2012:203-204; Mdlongwa, 2012:4; Chigona and Chigona, 2010:3).

2.8   CONCLUSION

This chapter focused on ICT mediated teaching and learning in the 21st century and the different learning theories that endorse the use of ICTs in the teaching and learning environment. It also discussed the theoretical framework underpinning this study. The principles, the significance of behaviourism, constructivism and connectivism in ICT teaching and learning as well as the critique of each theory were highlighted. The discussion showed that the evolution of the learning theories is not as important as the impact each learning theory has in attaining the educational outcomes as outlined by the national educational policies.

The relevance of the theoretical framework was also indicated by virtue of the ubiquitous use of ICTs in all aspects of life. The discussion indicated the need for teachers in particular to employ ICTs in pedagogical practices in order to gain and share knowledge with their peers, to improve their teaching strategies to enable their learners to achieve the 21st century learning skills. The network society theory was used to highlight some ICT challenges encountered by teachers and learners in some South African schools.

The following chapter will focus on the literature review of the use of ICTs in various countries of the world and their impact on teaching and learning in the schooling system.

CHAPTER 3

THE ROLE OF ICT IN THE TEACHING AND LEARNING SITUATION

3.1   INTRODUCTION

This chapter reviews relevant literature pertaining to the use of ICTs in the field of teaching and learning in the schooling system. It discusses the concept of ICTs as seen by various scholars and examines the pervasive impact and influence ICTs have on the present environments as constituted by the teaching and learning process. The rationale for the use of ICTs in the education field as an integral aspect of the teaching and learning situation is endorsed and not denied. Policy documents on ICTs from the Departments of Education form the basis of why and how ICTs should be implemented in the teaching and learning process. The study further explores both teachers' and principals' attitudes towards ICTs in selected education institutions. Principals and teachers are important agents who determine the success or failure of any innovation introduced in the education system especially where teaching and learning form the focal point for transforming the schooling environment.

3.2   ICT IN THE TEACHING AND LEARNING ENVIRONMENT

Information and Communication Technology (ICT) is of significant importance for the current study hence, it is essential to explain it and its role in teaching and learning occurrence. According to UNESCO (2012:2), ICT refers to all technologies that are used for processing information and communication. Cavas *et al.*, (2009:21) view ICTs as technologies that facilitate the acquisition, storage, processing, transmission and dissemination of information by electronic means.

These tools include hardware, software applications and information systems available to make it possible for data to be transmitted to anyone at any place in the world where the signals can be received. Shan Fu (2013:112) concurs with these definitions of ICT and further adds that electronic delivery systems are widely used in today's education undertakings and expand access to education thereby making it possible for learning to

occur anytime and anywhere. The importance of ICTs in acquiring and distributing knowledge in the third millennium can be compared to the impact of the invention and use of electricity in the industrial age. Castells (2007:246) further characterises ICTs as the communication foundation of the network society; the global web of horizontal communication networks that include the exchange of interactive messages from many to many unlike communication in the industrial era which centred on distributing one-way messages from one to many.

In cognisance of the proven significant potential realised in using technology, developed and developing countries use ICTs for social and economic growth as well as enabling full participation in the knowledge society. In countries, such as the Republic of Korea, over and above using ICT for the advancement of the knowledge society ideals, computers are used in schools to bridge the digital divide and promote education equity, and enhance the quality of education by improving teaching methods and also to promote science and technology education (Hwang *et al.*, 2010:7).

In the Third World, ICTs are viewed as a solution to social ills such as poverty and a means of bridging the digital divide. In addition to the view of ICTs as panacea for the social ills, Peeraer and Van Petegem (2011:237) posit the view that ICTs in Third World countries have been identified as a means to leapfrog into a globalising and a technological world. In the education sector, ICTs are regarded as resources which teachers and learners can use for enhancing the quality of education because they can be used as a tool for browsing the internet, storing, managing, and communicating information. ICTs can support teaching and provide teachers with the tools to support learning thus making learning accessible and assisting in research activities (Makura, 2014:43; UNESCO, 2012).

From an educational point of view, ICTs are regarded as valuable cornerstones of education in the knowledge society for they can be employed to help learners acquire, share and distribute knowledge. Focusing on the new knowledge paradigm, it is important to note that with the use of ICTs, knowledge can be used multiple times without depreciating and can be used and shared by many people at little cost (Kozma, 2010:13). Teachers and principals are therefore critical agents for promoting these benefits and are responsible for the production

of knowledgeable citizens who will play a vital role in ensuring that a country develops and also modernises.

In the South African education system, technology is one of the subjects offered in primary schools as Natural Science Technology and in high schools as Technology. The critical outcome for natural science and technology teaching is to sustain enjoyment and curiosity about the world and natural phenomena and learners are expected to gain an understanding of different cultural contexts in which indigenous knowledge systems were developed (DBE, 2011:8). The DBE (2011:9) further states that the rationale for teaching technology subjects is to provide elementary engineering and technological skills essential for the world of work, higher or further education and self-employment. From the DBE point of view it is clear that technology subjects are offered for social, vocational and economic reasons which are held in high esteem in the knowledge society.

 ICTs are also used in Language literacy, Mathematics and Science because these subjects are the ones in which South African learners performed poorly, according to Progress in the International Reading Literacy Study (PIRLS) and in Trends in International Mathematics and Science Study (TIMSS) assessments (HSRC, 2011:4). South African learners have continued to perform at the low end of the ratings for both mathematics and science (Van der Berg, 2016:2). The worst performance of learners in literacy and numeracy was found in black schools as revealed by the National School Effectiveness Study (NSES) testing (Van der Berg *et al*., 2011:1). The dismal performance calls for innovative solutions which include the integration of ICT for effective teaching and learning.

ICTs can be used in various educational environments and can also be influenced by the learning theories as expounded on in the previous chapter. Teachers and learners can engage in the process of learning from the ICTs and learning through ICTs. Learning from ICTs is in line with the behaviourist principles and techniques (Ertmer and Newby, 1993; Hung, 2001) in which the ICT tool is the teacher responsible for delivering the subject matter to be learnt as well as assessing if learning has occurred. This ICT tool signals when the subject matter has been learned by giving immediate positive feedback, signalling a change in behaviour.

The second mode of learning with ICTs involves the learner using ICTs to attribute meaning to the content and using cognitive functions for exploration and discovery (Lehtinen, 2010:82). In this situation learners are responsible for their learning and the teacher serves as a guide in the learning process. The last mode of learning through ICTs differs from the above modes in that it focuses on online learning and is practiced in distance learning where there is no face-to-face contact between the teacher and the learner.

Several terms are used to denote learning that moves beyond the walls of the classroom: eLearning is one of such concepts and is defined as any learning that delivers information, communication, education and training by utilising technology especially the internet (Boyinbode and Akintola, 2009:205; Yahya, Ahmad and Jalil, 2010:118). This term is widely used in business, industry and education because it combines the electronic environment and learning and thus puts emphasis on learning through ICTs. The three modes of using ICTs in learning are all beneficial to learners even if they are passive rather than active participants in the learning process. Teachers' expertise and competencies in the use of different forms of ICTs can support different levels of learning. The nature and the form of ICTs used are determined by the learning content, the goals and learners' different ways of learning.

Having examined the critical role of ICTs in the teaching environment and the different modes of learning, the next section will investigate how ICTs can best be combined with teaching methods, starting with a comparative study of ICT education polices in a number of different countries.

3.3   EDUCATION POLICIES ON ICTs IN DIFFERENT PARTS OF THE WORLD

Various education policies in many countries such as Scotland, Ghana and South Africa emphasise the critical importance of including ICT in education in addition to reading, writing and arithmetic (the so-called 3 Rs). This is due to the fact that these governments with their education departments expect teachers to have an understanding of the representation of concepts using technologies and pedagogical techniques to teach

content as indicated in TPACK framework (Koehler and Mishra, 2009:66). Teachers are expected to know how technology and content influence and constrain one another and know the technological tools that are suitable for teaching the subject matter. Technological Pedagogical Knowledge (TPK) focuses on knowing how ICTs can enhance the learning and teaching processes. The interconnection of the knowledge areas is essential for teaching and learning with ICTs. Therefore the teachers' TPACK expertise is critical as it directs teachers on how ICTs can be used to access and teach the subject matter and how it can support and enhance learning. Koehler and Mishra (2009:66) state that the disregard for the relationship between and among the knowledge areas can result in a failure in ICT implementation in teaching and learning.

Many countries expect school and college leavers to have the technological skills to enable them to function in the knowledge-based society (Doyle and Reading, 2012:1). However, the transfer of these ICT skills depends on teachers in the classroom. Msila (2015: 1976) Ndlovu and Lawrence (2012:4) as well as the DBE (2007:6) and GDE (2007:11) concur that teachers are pivotal in seeing and ensuring that ICTs are integrated in the classroom. This requires ICT proficiency which comprises technological and pedagogical skills as well as knowledge of the subjects they are teaching. Five proficiency levels are identified: the lowest being the entry level which is characterised by lack of ICT skills necessary to create learning activities; next is the adoption level which indicates teachers' acceptance of ICTs and indicates they have the skills to use the computer and the software; at the adaptation level, teachers are able to integrate ICTs into teaching and learning; the appropriation level describes teachers who use ICTs for their own use; and the highest level is the innovation level in which the users specialise and innovate in ICT in education. The challenge with many South African teachers in urban and rural schools is that they do not use ICTs because their proficiency level is mainly at the first or second levels (Ndlovu and Lawrence, 2012:4). These research findings highlight the challenges the DBE faces with skill shortages, an issue which needs the urgent attention of all parties in education. Therefore the DBE, GDE and universities have the responsibility to produce teachers who are at the third ICT proficiency level in order to implement ICTs in the manner that is described in the South African ICT in Education Policy.

Training programmes such as the CRAR3FS2 framework (Du Plessis and Webb, 2010) also emphasise the characteristics that must be heeded by trainers when training teachers on the integration of ICTs in teaching and learning. CRAR3FS2 is an acronym for Care, Relate, Assess, Reflect, Read, Re-Plan Feedback, Share and Support. It is believed that CRAR3FS2 could be a suitable framework for training teachers, particularly those who have negative attitudes and beliefs about the affordability of ICTs in teaching and learning. CRAR3FS2 could also be used to achieve the ICT adaptation proficiency level considered by the DBE and GDE to be the basic requirement for teachers to be able to implement ICTs in their teaching responsibilities.

This section focuses on how ICTs can be combined with teaching methods, beginning with a comparative study of ICT education polices in different countries in which the rationales for ICT adoption and its effective use in developed, developing and under-developed countries are compared. The comparison is important in that it can help in addressing educational challenges and improve the quality of teaching and learning. The results will highlight how ICTs are combined with the teaching methods in order to assist learners achieve the goals as intended by the specified ICT rationales.

Hawkridge (2006:59) identifies four rationales which justify the introduction and use of computers and the internet for information processing and electronic communication between individuals and countries especially in African countries. These rationales also motivate countries to invest in ICTs in order to attain the competencies deemed indispensable and relevant in today's knowledge society. As a result Hawkridge (2006:59) highlights the importance of the use of ICTs in African schools since schools are considered ideal places for preparing learners for life and for being effective members of the knowledge society.

The first rationale is the *social rationale* which emphasises teaching basic ICT skills in order to prepare and enable learners to take their place in society. The *vocational rationale* indicates how ICTs are important in giving learners appropriate skills for future jobs including jobs that may not yet even exist. The p*edagogical rationale* is based on the capacity of ICT to enhance teaching and learning. The fourth rationale is the c*atalytic*

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rationale which focuses on the ability of ICT to bring about change in education. In addition to Hawkridge's rationales for the use of computers in schools, Smit (2013:4) and Voogt (2012:3) include the *information technology industry rationale* that pertains to the promotion of the ICT industry in education. The last rationale is the *cost-effective rationale* and focuses on the fact that ICTs have the capacity to reduce costs of education in the sense that the money used for purchasing ICTs will be paid once, whereas the equipment will be used by many learners and for many years. This cost covers hardware and the software could be used for a long period of time unlike books which need to be paid for every year.

Although the six rationales are all important and are the bases for ICT use in all spheres of life around the world, only four rationales are recognised in the adoption of ICTs in teaching and learning and are listed as follows: social rationale, vocational rationale, pedagogical rationale and catalytic rationale. Smit (2013:5) states that these rationales are critical in determining national and school policies due to the fact that they are relevant to 21st century requirements, they are aimed at the creation of a self-directed future workforce and the promotion of the knowledge society as alluded to in Chapter 2. Although the rationales are distinguishable, they are inseparable and reinforce one another (Smit, 2013:5).

Based on the various rationales for ICT adoption in education, countries have different national goals for ICT use in education and consequently different policy initiatives and strategies in place to enforce ICT use in teaching and learning to ensure successful implementation and maintenance of high quality use by school leadership, teachers and learners. Countries such as the Republic of Korea (Dae, Yang and Hyeonjin, 2010:29) invest in ICTs firstly for the development of an educated and lifelong learning society and to ensure national competitiveness. Secondly, the introduction of ICTs in Korean elementary and secondary schools is aimed at improving teaching methods and for the preparation of the knowledge society. The other purpose for ICTs in schools in First World countries is geared at enhancing the learning experience by providing a collection of learning and teaching materials that make lessons more attractive, visually or aurally stimulating, to

cater for individual learning styles and to encourage learners to do their utmost best (Sankey, Birch and Gardiner, 2010:853).

With many developed and developing countries acknowledging the importance of ICT in education, education authorities play a role in the establishment of ICT in education policies in areas that cover computers and handheld devices, network equipment, connections to the internet and services for learners and teachers. It is noted that the parents contribute to enabling their children to use ICTs at home (Kozma, 2010:2-4). The home extends and provides a platform to continue independent learning for knowledge acquisition and problem solving which are the cornerstones for modern learning in the new network society.

In replicating First World countries' ICT initiatives in education, the use of ICTs in developing countries is being introduced to reform education and to provide equal and universal access to knowledge for sustainable development (UNESCO, 2008). According to Kozma (2010:14), ICTs in developing countries are used to change the lives of people especially when these tools are relevant to local needs and when local languages are used. ICTs are therefore regarded as dependable tools which provide better ways for teachers to adjust learning and teaching to individual needs and differentiate learning. According to Chigona *et al.*, (2014:1) and Aktaruzzaman *et al.* (2011:114), ICTs expand access to education, strengthen the relevance of education to the digital workplace and raise the quality of education by making teaching and learning an engaging and active process. This potential compels schools around the globe to implement these technologies in order to attain national and educational ICT goals.

In the ensuing discussion the researcher will examine ICT education polices in three countries: Scotland, Ghana and South Africa. Scottish ICT education policies represent a developed country; the Ghanaian ICT policy represents a Third World country and the South African ICT in education policy represents a developing country with the focus on Gauteng schools.

3.3.1 Scottish ICT in Education Policy

The global adoption of ICTs in educational institutions is geared to transform the culture of teaching and learning, promote education equity in bridging the digital divide, prepare learners and students for the knowledge society and accelerate national development efforts (The Highland Council, 2015:2; Dae *et al.*, 2010:7; Akbulut, Odabasi and Kuzu, 2007:175). The same objective of promoting anywhere and anytime learning for teachers and learners and the achievement of pupils, which manifests in their having the knowledge, skills, attitude and capacity to positively contribute to contemporary society, is evident in the Scottish education system. In accordance with this assertion, the Scottish Government's ICT in Learning mission is to prepare pupils for success in the rapidly evolving digital world and to enable learners to develop ICT skills that will support them in their education, lifestyles and the world of work (The Highland Council, 2015:7). In terms of policy, this objective can be achieved by routinely and effectively embedding ICT in all aspects of learning and teaching.

Scottish policy makers and education departments prioritise the implementation of managed services and the development of programmes for ICT provision. In all its council schools, the Scottish government focuses on five key areas: infrastructure, appropriate technologies, good pedagogical practice, school leadership and professional learning for the full and successful ICT integration in teaching and learning (The Highland Council, 2015:7-8). In addition, policy makers provide schools with clear guidance on appropriate measures to ensure mitigation of risk and compliance with council ICT policies (Edinburgh Council, 2015:8).

In terms of ICT infrastructure, according to the Edinburgh Council (2015:2), secondary school learners in selected ICT model schools are provided with individual devices such as iPads and tablets for more creative learning at school and at home. A different approach is used in primary schools where clusters of devices are provided in each class to be shared by small groups of learners (Edinburgh Council, 2015:2; Collie, Lewis and Méro, 2011:9). The grouping of learners is beneficial because it promotes cooperative learning which is considered an important 21st century skill. In such a setting, learners with different

learning potentials are afforded the opportunity to work together. Able learners help struggling learners understand the learning material and achieve their learning outcomes. This also develops self-confidence and a sense of independence that comes with successfully accomplishing learning tasks. In this educational scenario, teachers are encouraged to employ constructivist teaching principles in which teachers become coaches thereby allowing learners to immerse themselves in the learning process and take charge of their construction of knowledge through active participation.

In terms of the Highland Council's ICT provision programme, service providers are responsible for developing enabling infrastructure and technology rich environments in schools and providing mobile devices such as iPads to pupils in model schools (The Highland Council, 2015:7). As laid out in the ICT policy (The Highland Council, 2015:7) Scotland's national intranet for schools, Glow, is available to all schools, providing teachers and learners with personalised access to the intranet, virtual learning and a variety of tools to enable collaboration, cooperation and communication across the network. According to Wilson and McKinney (2012:58) The Curriculum for Excellence and Aruba Wireless is available in all schools providing internet access for both teachers and the learners throughout the establishment (The Highland Council, 2015:7).

Scottish education departments also recognise teachers as key determinants of effective and efficient use of ICTs in teaching and learning (Wilson and McKinney 2012:67). This is evidenced by the establishment of Curriculum and Technology (CaT) Coach model to ensure that teachers become confident and competent in the integration of technology into their teaching activities (The Highland Council 2015:7. Consequently the departments offer programmes for continuing professional development of ICT skills for teachers to enable them to incorporate technology into daily classroom practice and to keep abreast of new developments.

As ICT leaders, school principals are tasked with developing plans with ICT teams in order to take the school's vision for ICT learning forward. Principals use the online Head Teacher Toolkit to access necessary information thereby modeling ICT usage to their teachers and learners as required. As the manager, the principal must establish and introduce 'Digital

Leader' roles for pupils to support the development of ICT in learning within the school. Some responsibilities of the school principal in Scottish schools include the focus on arrangements of ICT equipment in schools, budgeting issues, purchasing software and choosing hardware, employing ICT coordinators and they are responsible for the development of the school-based ICT policies.

As discussed, the fact that all learners have equitable access to a range of ICT resources to support their learning in school means that all learners and teachers are catered for in terms of ICT integration. The routine use of ICTs by teachers across a range of curricular areas to provide realistic and motivating contexts for learning and the supporting ICT staff implies a conjuncture between policy and the implementation in the schooling environment in Scotland. The observance of the principal's role of ICT leadership by all principals also ensures the positive implementation of ICTs across the curriculum. The following discussion will focus on Ghana as a developing country as compared to Scotland as one of the well-developed country.

3.3.2 Ghanaian ICT in Education Policy

The Ghanaian government through its ICT for Accelerated Development (ICT4AD) policy emphasised ICT use in order to bridge the digital divide between Ghana and the developed world. The main objective of ICT in the education sector is to improve the quality of education and training and to make the educational system responsive to the needs and requirements of the economy and society with specific reference to the development of information and knowledge-based economy and society (Ghanaian MoE, 2015:10; Ghana MoE, 2008:10; Mangesi, 2007:3). As a result the Ghanaian MoE puts more emphasis on the introduction of ICTs at pre-tertiary level to enhance teaching and learning as well as teaching ICT skills to all students in order to prepare the youth for future ICT professions (Ghana MoE, 2015:15-19).

The policy initiative implies a systematic and a collaborative plan which focuses on providing ICT facilities in all schools and internet connections, building teacher confidence and ICT competencies through professional development programmes and encouraging

stakeholders such as private organisations, NGOs, parent-teacher associations and students associations to collaborate in the successful integration of ICT in education (Ghanaian MoE, 2015:8). The commitment of the Ghanaian government to roll out and integrate ICTs in teaching and learning is evident in its policy stipulations and educational goals. However, the big challenge lies in the reliance on international partners for financial and technical support which can lead to the early demise of the projects once the initial funding runs out (Ghanaian MoE, 2015:11).

In spite of establishing computer laboratories and the provision of essential ICT material, the Ghanaian MoE (2015:15) and Mangesi (2007:8) report that another challenge experienced is the lack of policy direction at schools, at both district and national level, on how to integrate ICT in education. This creates problems both within schools and between schools as principals and teachers have no clear directives on what to do with the ICT tools. Researchers (Mangesi, 2008:8) also indicate a disparity in terms of access to ICTs between public and private schools as well as between urban and rural areas. Well-resourced schools are integrating ICT into teaching and learning with ease whereas rural schools are left with challenges that hinder the implementation of technology. Malcolm and Godwyll (2008:19) concur stating that the major challenges in ICT integration in Ghanaian schools are high learner-computer ratios, computer breakdowns, and unreliable internet connectivity.

Nkula and Krauss (2014:245) and Malcolm and Godwyll (2008:20) further highlight the lack of professional development programmes to upgrade teachers on new technological innovations. Another obstacle relates to the inability of ICT coordinators to maintain ICT equipment and support teachers, learners and administrators. The findings by Buabeng-Andoh (2012:45) further reveal low integration of ICT into teaching and learning by many Ghanaian teachers due to lack of ICT skills. This assertion corresponds with the claim by Malcolm and Godwyll (2008:19) about the lack of programmes for professional development. The Ministry of Education needs to devise a model which will enable all teachers to be ICT competent in order to achieve their educational goals. The dependence on external funds is also cause for disappointment as most initiatives stopped after depletion of the initial funding.

Based on the discussion in the previous paragraphs, it is apparent that there is a gap between ICT policy planning and implementation in Ghana. This indicates a lack of collaboration among the various stakeholders. Clear directives are essential in informing users on how to integrate ICTs in order to realise the benefit of improving education. A well-developed national policy should be used as a base for the individual school policies to ensure uniformity. Poor budgeting and poor planning result in funds being exhausted before getting what is intended. This is indicative of the fact that conscientious and thorough planning is of significant importance for successful ICT integration at schools.

Allocating more funds for ICT infrastructure and professional development of teachers at national and school level is a factor that should be considered by educational authorities. Like Ghana, the South African President, through the launch of Operation Phakisa emphasises the importance and integration of ICTs in education to attain national ICT education goals which will produce ethical, discerning and responsible ICT users who are able to make a meaningful contribution to the South African society. Acknowledging the critical role teachers play in teaching and learning, the President reiterates that ICT teachers should have access to the necessary resources in order to create effective learning opportunities for all learners and engage in online programmes to enhance their professional skills and strengthen their content knowledge for the delivery of the curriculum. The President's statement is consistent with Sipilä's assertion (2014:238) that new ICTs require new teacher roles which call for collaboration, knowledge building and online knowledge sharing. In the South African context, the emphasis of teachers' use of non-traditional methods and ICT for enhanced teaching and learning is clearly illustrated in the ICT in education policy which will be discussed next.

3.3.3   ICT Policy in the South African Education System

The South African government through the DBE as well as the Provincial Departments of Education, especially the GDE regards ICTs as a resource for reorganising schooling and a tool for whole school development (DBE, 2004:8). To this end, the GDE policy on eLearning is encapsulated by Goal 1 (GDE, 2007:14) which entails the improvement of teaching and learning through the use of ICTs. The aim is to create wider access to learning opportunities,

redress inequalities, improve the quality of learning and teaching, and deliver lifelong learning in Gauteng Province. The actualisation of this national goal led to the establishment of laboratories with 25 computer work stations and internet connectivity for learners in Gauteng public schools. While this gesture is welcomed by all stakeholders, ICT integration in teaching and learning has not been effective as envisaged. The factors that contribute to or impede the effective use of ICTs in the teaching and learning environment are discussed in the subsequent paragraphs.

Basic ICT infrastructure is inadequate for all learners enrolled in a school. Mooketsi and Chigona (2014:4) concur stating that the ratio of learners to computer access inevitably results in sporadic use of computer technology. Therefore, neither teachers nor learners get adequate exposure necessary for either literacy or integration of ICTs into teaching and learning. Lack of funds and non-payment of school fees are undermining the GDE policy initiative of moving ICT into the classroom. However, the GDE is firmly committed to the digitisation of education and the Gauteng MEC of Education is determined to convert Gauteng schools into paperless schools by providing computer tablets to supplement and enhance teaching and learning and raise educational standards. These moves are also motivated by the desire to produce learners who can read, write and calculate and to enable South African learners to compete with the most highly developed countries (Msila, 2015:1975).

The success of integrating ICTs in teaching and learning depends on teachers having the correct attitude towards the innovations otherwise the project is doomed to be a failure as it was the case with the GoL project which was established to provide schools with computers and the internet connectivity for the enhancement of teaching and learning in Gauteng (Sukazi and Ntshingila, 2013:1). Despite the efforts made to have GoL up and running to enable teachers and learners to use ICT innovations, the services are irregular and sometimes unavailable due to poor planning and governance. According to Serrao (2012:1), the audit conducted in fifty schools in five Gauteng districts found among other factors that GoL was offline most of the time (Serrao in Pretoria News, 2012, May, 8). Parents are important actors in the provision of their children's education and should

comply, where possible, in providing ICT gadgets and thereby contributing funds to help the government.

Although many South African rural areas have been developed in terms of electricity and telephone lines which are basic requirements for internet access, Mlitwa and Nonyane (2008:12) and Mooketsi and Chigona (2014:4) maintain that some schools in deep rural villages still have no access to electricity and internet facilities. Internet costs are a major obstacle since many people are unemployed. Research studies (Mdlongwa, 2012:7) have discovered that power cuts, the unavailability and the eventual cancellation of the GoL initiative which was established to provide internet connectivity, computer literacy and the eLearning environment in Gauteng public schools were some of the challenges schools encountered in using the internet. The national ICT in Education Policy also states that ICT be integrated from five-year olds in the reception class, Grade R, through to 18-year olds in their final year, Grade 12, across the curriculum (White Paper, 2004). Despite the 25 computers available in the GoL laboratories, many teachers are not sufficiently skilled to integrate ICT in teaching their subjects despite the training they have received (Ndlovu and Lawrence, 2012:5). The integration of ICTs in any grade or school depends on teachers' appropriation of ICT. However, many studies (Peeraer and Petegem, (2011:238) Aslan and Zhu (2015:366) and Msila (2015: 1979) indicate that teachers are still not confident about using ICTs due to the lack of competency and lack of or inadequate training.

Negative attitudes and clinging to traditional methods of teaching are also said to be factors that deter teachers from using ICTs in teaching, findings attested to in South African schools by Msila (2015: 1978), Chigona and Chigona (2010), Mdlongwa (2012:4-5). These researchers say these stumbling blocks contribute to widening the digital divide between urban and rural schools. From the policy initiatives it is clear that the practice of ICT use in the school environment can lead to a disjuncture between theory and practice.

The ICT in education policies of Scotland, Ghana and South Africa have been analysed, not to compare the three countries, but to establish the basis for successful integration and to determine how ICTs are integrated in the selected countries. The ICT in education policies of these three countries are illustrated in Table 3.1.

Table 3.1: Summary of Education Policies on ICTs in three different countries

Policy stipulations	Scotland	Ghana	South Africa
Rationale for ICT integration in teaching and learning	• Preparing pupils for success in the rapidly evolving and digital world • Enabling learners to develop ICT skills that will support them in their education careers, lifestyles and world of work • Children and young people are encouraged to be innovative and critical designers of the future	• ICTs are incorporated to bridge the digital divide between Ghana and the developed world • Development of knowledge based economy and society. • Creation of possibilities for learners and teachers to engage in new ways of information acquisition and analysis	• ICT is a resource for reorganising schooling and a tool for the whole school development • Creating wider access to learning opportunities, redressing inequalities, to improve the quality of learning and teaching and o delivering lifelong learning
ICT Infrastructure	• Endorsement of non-textual approaches • Provision of adequate ICT resources for innovative teaching opportunities and effective learning in all aspects of school life	• The Ghanaian Ministry of Education provides ICT facilities in all schools	• GDE established computer laboratories and provided tablet computers but are inadequate for learners and teachers. • Non-use of tablets by teachers and learners
Internet access	• Learners have access to intranet and internet to get information and for communication	• The Ghanaian Ministry of Education provides internet connections	• The GED established GoL for the provision of internet connections.

			• Tablets have internet connectivity
School principals as ICT leaders	• School principals are key figures in ensuring the success of ICT integration in schools • Use online Head Teacher Toolkit for the necessary information • Establishes other local structures to support the development of ICT use within the school • Principals are responsible for the development of the school-based ICT policy	• Principals lack ICT leadership skills • Lack of policy direction • Absence of school-based ICT policies	• Majority of the school principals lack skills to model ICT leadership in their schools • Lack of school-based education policy
Role of teachers	• Teachers are essential for successful ICT integration in teaching and learning	• Teachers are acknowledged as key figures in integration of ICT for teaching and learning but lack of ICT skills among teachers is a major challenge	• The integration of ICTs depends on teachers; however many teachers lack the necessary ICT skills
Professional development	• Teacher development is undertaken to enable teachers to develop ICT skills for use in the classroom and to keep teachers abreast of new technologies	• Lack of professional development programmes	• Education policy on ICTs emphasise programmes for teachers' professional development however negative attitudes towards ICTs and tendency to cling

			to traditional methods of teaching deter teachers from incorporating ICT in teaching and learning
Human capital	• All stakeholders (teachers, education authorities, support staff and parents) contribute in ensuring that learners acquire ICT skills that will render them employable even if they drop out of school	• All stakeholders are encouraged to collaborate to ensure successful integration of ICT in education. • Incapacity of ICT coordinators to maintain ICT equipment and to support teachers, learners and administrators	• All stakeholders are expected to collaborate to ensure successful integration of ICTs in teaching and learning

The rationale for the various policies on ICTs in teaching and learning puts more emphasis on the development of active, creative, knowledgeable and ICT skilled learners who will be able to function in the knowledge society. The importance of the key roles of the teachers and the principals are evident in the Scottish education system in that training and their professional development is adequately considered and implemented as per its ICT in education policy. Although the principals and teachers in Ghana and South Africa are very enthusiastic about the integration of ICTs in teaching and learning, the lack of ICT skills and the relevant knowledge in terms of how to institute and support ICT use in schools is indicative of the fact that the introduction of workshops and a principals online toolkit is a necessity. Compulsory engagement of teachers in community of practice is encouraged in order to develop the skills and the confidence for ICT integration and to be able to implement the country's ICT in education policy. Learners are regarded as important stakeholders in the arena of ICT usage in teaching and learning and ICTs in schools are created to support and inspire them to acquire knowledge, for social development and to

prepare them for their future jobs. The impact of ICTs on learners is investigated in the following discussion.

3.4   THE IMPACT OF ICTs ON LEARNERS

ICTs and networks are indispensable in learning situations because they offer learners opportunities to operate in the information society while traditional teaching methods only prepare learners to reproduce what they have been taught instead of being productive. Consequently, the impact of technology in education is of significant importance to the learning process and the ultimate goal of producing skilled workers who will be able to perform and compete in the globalised market (Chigona *et al.*, 2014:2; Siemens, 2008:3-4). Cognisant of 21st century skills and globalisation, research by Starkey (2011:23), Van Rij and Warrigton (2010:2) and Shin *et al.*, (2012:548-552) confirm that through the use of ICT, learners are enabled to be active and creative, learn how to learn, perform better in Mathematics, Science and languages and acquire digital and social skills necessary to participate in their personal worlds, future society and anywhere where ICTs play a significant role. Hunde and Tacconi (2013:707) Starkey (2011:22), Redecker *et al.*, (2010:3) maintain that ICTs are to be used as tools to attain educational skills for searching, assessing and distributing information, cooperation, communication, critical thinking and problem-solving which are important in preparing learners for the knowledge and the network society.

Nyambane and Nzuki (2014:2) concur, stating that ICTs have the potential to strengthen the importance of education in the networked society and to enhance the quality of teaching and learning by associating with real life situations. The same fact is suggested by UNESCO (2012:6) which states that learners and students in ICT-supported pedagogical practices are actively involved in their learning projects; they are presented with opportunities to plan their own learning and engage in the assessment of fellow learners' performances. These pedagogical activities are goals which are considered to be of significant importance in the knowledge society. Given these assertions, teachers are expected to use ICTs to create educational settings which will allow autonomous learning and enable learners to acquire the skills and knowledge regarded relevant in the 21st century.

Based on research findings, Mwalongo (2011:45) and Hennessy, Harrison and Wamakote (2010:49) maintain that new ICTs have the ability to transform teacher-centred pedagogy into learner-centred pedagogy and ICT generates multiple informational sources which are not possible in traditional methods of teaching and learning. The use of ICTs can help teachers to expand their horizons and empower them to use these resources as a teaching tool, access information and to communicate with colleagues or experts, which, in turn, contributes to their professional development.

In this technological age, teachers have an obligation to use ICT in teaching and learning environments due to the fact that today's learners are inspired by ICTs and use them in most of their daily activities. Therefore, a little or a total lack of ICT integration in teaching and learning will deprive learners and see them being excluded from the global community. As key figures in the production of the future workforce, teachers must familiarise themselves with the new technology in order to cope with developments and ensure educational and national ICT objectives are attained. It is critical for teachers to start by using available ICT resources to familiarise themselves and gain basic skills. As they grow more confident they will be in a position to progress to an advanced level of ICT usage which will improve teaching and learning in their classes. Makgato (2012:08) and Mdlongwa (2012:4) further state that using learner-centred approaches along with ICTs allows learners to be effective participants, knowledge constructors, effective information seekers and critical users. Given these findings the researcher is of the opinion that it is incumbent on teachers to acquire the skills necessary to be able to use ICTs effectively in the classroom, as ICTs have a positive effect on learners' learning and these effects are in line with the skills required in the network and knowledge-based society as discussed in paragraph 2.7.

This is consistent with the constructivist principles for teaching and learning as indicated in section 2. 5. 2. 2 of Chapter 2, which are regarded as highly relevant for learning in the 21st century and essential in the knowledge and network society. By using ICTs, learners can solve contextual problems collaboratively as well as real life problems by exploring, evaluating, manipulating and integrating available information from an array of sources as opposed to passively acquiring information from the texts selected by the teacher. It is interesting to note that without instruction, learners discover and use different features of

the technology, teach each other and do some surfing on the web. Research findings (Mwalongo, 2011:45; Makgato, 2012) also posit that students and learners use the internet to search for material and information to broaden their understanding of subject matter. Laaria (2013b:227) further states that in schools where ICTs are well utilised, learners are motivated to engage in authentic learning and are discouraged from dropping out of school.

In their findings regarding the use of game technology in learning mathematics, Shin *et al.* (2012:548) claim that learning and mastery of ICT-related skills and the procedural understanding of subject matter happen by doing or by being helped by others. This is consistent with the use of ICTs to create networks for the acquisition and distribution of current information as indicated in the discussion on network theory in sections 2.5.3.3 and 2.7 of chapter 2. According to Dede (2008), ICTs in line with behaviourist tenets, are used to accommodate the individual characteristics of the learner. Drill and practice and tutorials allow the learner to master knowledge and skills at their own pace. Immediate and accurate feedback is aimed at enabling learners to achieve set goals and to be successful in their learning activities. Taking the different learning theories and learning processes into consideration, learners with different needs and learning styles are catered for in learning with ICTs.

A large body of research endorses the multifaceted benefits brought about by ICTs in learning. According to Shan Fu (2013:113-114) and the Education, Audiovisual and Culture Executive Agency (EACEA) report (Balanskat, 2007:23), ICTs have a positive impact on instructional and educational goals such as student attendance, language development especially in the early stages, behaviour, motivation, attitudes, confidence and engagement. The findings also point to finer differentiation and personalisation and improved learning outcomes for disadvantaged learners. Due to these positive potentials in terms of the learning process, the infiltration of ICTs in education is acceptable to the majority of people who are affected and empowered by ICTs in their daily lives. Although worldwide countries endorse the use of ICTs for all learners, research (Balanskat, 2007) indicates that the benefits of ICTs in improving learning are only enjoyed by a small number of learners. This is reiterated by Mooketsi and Chigona (2014:4) who state that rural

learners and urban school learners, whose schools are in disadvantaged areas and not resourced with ICT equipment, are excluded from the benefits of ICTs.

In addition, learners taught by teachers who resist ICTs are also denied the opportunity to be ICT users due to teachers' negative attitudes. The researcher contends that learners who are denied the use of ICTs due to teacher attitudes are disadvantaged and excluded from becoming part of the new society and are not equipped for jobs of the future. It is incumbent on all teachers to embrace ICTs because learners with different potential and different learning styles can be accommodated by the diverse educative material inherent in ICTs, irrespective of their social backgrounds. The use of teaching strategies informed by learning theories and ICT can help all learners realise the benefits of ICTs and achieve learning outcomes as expected by teachers.

While teachers who have a duty to ensure that instructional goals are achieved, the school leadership also has the responsibility to influence and ensure that both teachers and learners succeed in their responsibilities. Consequently, school principals by virtue of being managers are also expected to support successful ICT integration in teaching and learning for the realisation of educational goals and lifelong learning. This is consistent with Laaria (2013b:18) who finds that the principal should be the motivational force who encourages staff members to embrace technology in order to improve the quality of their work. Similar findings by Afshari, Ghavifekr, Siraj and Samad (2012:283) confirm that school principals who exhibit transformational behaviour and use ICTs in administrative and instructional tasks, are capable of transmitting the ICT mission and vision for comprehensive ICT integration for the enhancement of teachers' productivity and professional practice. The role of the school principal as an agent of change and an ICT leader responsible for creating an environment conducive for ICT use at school will be discussed next.

3.5 THE PRINCIPAL AS AN ICT LEADER

The principal is an instructional leader who has the responsibility to ensure that the teachers are teaching and the learners are learning. According to Nkula and Krauss (2014.254) and Lunenburg (2010:3) additional responsibilities of the instructional leader

include coordinating teaching and learning activities, organising the teaching and learning environment, controlling teaching and learning, and, together with teachers, devising strategies to address learning challenges. Laaria (2013a:1) corroborates the role of the school principal and further states that as the manager, the principal is also in charge of resources, including ICT infrastructure, and is responsible for seeing that teaching and learning activities take place effectively and smoothly as indicated in section 3.3.1.

Research (Abdullah, De Witt and Alias, 2013; Lunenburg, 2010:2- 4) has indicated that the role of the principal, as an instructional leader and a leader among other leaders, is to promote learning thereby ensuring that every learner receives the highest quality instruction each day and that learners succeed in their learning activities. To ensure successful ICT integration, Kannan *et al*. (2012:111) maintain that the school principal is bound to provide and create opportunities for professional development of teachers to acquire and improve teachers' ICT skills. Thus, by focusing on learning, the principal must provide support and encourage teachers to collaborate in dealing with issues that relate to individual or group learning. To support teachers, teams can be formed to motivate them in a manner that allows skilled teachers to empower the unskilled teachers in advancing their ICT skills (Kannan *et al*., 2012:114; Al Sharija and Qablan, 2012:24).

According to Kannan *et al*. (2012:112) another critical role pertains to the principal as a technology leader, envisioning opportunities for ICT integration for teaching and learning. Afshari, Bakar, Luan and Siraj (2012:166) contend that as a transformational leader, the principal must have computing capabilities, be fluent in ICT basics and be an ICT user in order to motivate teachers to incorporate ICTs in their teaching practices. In this way the principal becomes a role model to his school community. It is therefore imperative that the principal provides ICT infrastructure for teachers and learners to engage in authentic teaching-learning experiences, provide the means for ICT training for teachers, and entrust capable and ICT-skilled teachers with the responsibility of assisting struggling teachers, demonstrating the affordances of ICTs when integrated with their pedagogies to attain the educational outcomes as stated in the educational policy discussed in section 2.2.

The principal's vision and mission regarding the place of ICT's in education must be in line with the national central policy and must be reflected in the school's ICT policy that is supported by all teachers and other stakeholders. The various roles of the principal as the instructional leader, transformational leader and ICT leader in the school environment are essential in enabling teachers with different capabilities and attitudes to adopt ICTs in order to heighten the pedagogic activities and goals considered essential for the knowledge society and the new methods of teaching and learning.

The researcher agrees that the role of the principal is to focus and promote the expectancy of excellence. As the head of the school the principal must unite and motivate staff members to achieve the educational goals. As the link between the Department of Education and teachers, the principal is there to ensure that the innovations and educational transformation such as ICT usage is embraced by all teachers through continuous professional development such as workshops and ongoing training, providing funds, ensuring access to ICT infrastructure and creating a positive atmosphere in order to benefit learners and teachers as expected by policy makers and education authorities as alluded to in section 2.2 of chapter 2. Although the principal's role of ICT leadership is of vital importance, teachers are equally key figures in ensuring that ICT usage is effective and successful for improving the quality of teaching and learning which ultimately must result in producing ICT capable and responsible learners. The use of ICTs as instructional tools for teachers in their pedagogic practices will be discussed in the subsequent paragraph.

3.6 TEACHERS AND THE USE OF ICTs IN TEACHING ACTIVITIES

Although the principals are portrayed as key to ICT integration in the school environment and have to model and encourage staff members and learners to use ICTs, researchers (Ouma *et al*., 2013: 1; Kannan *et al*., 2012:111; Ndlovu and Lawrence, 2012:20; Doyle and Reading, 2012:1; Mwalongo, 2011:36; Cavas *et al*., 2009: 21) concur that teachers are also catalysts and the driving force in effecting change in education by effective and efficient implementation of ICTs in the learning situation. The support rendered by principals to teachers who are adopting and using ICTs is essential to increase teachers' levels of confidence, motivation and morale. As an academically qualified person, the teacher is

expected to consider ICT practice to be an integral part of teaching and to devote particular effort to developing competencies in their learners such as creativity, decision-making, problem-solving, collaboration and life-long learning; attributes that are consistent with the practices of the knowledge society (Levinsen, 2010:1). The same sentiment is expressed by Gulbahar and Guven (2008:38) when recommending teachers embed ICT in significant learning in order to prepare learners for real life in a world determined by technology and characterised by diversity.

As a result of globalisation and the knowledge society, teachers are encouraged to abandon traditional ways of delivering information and adopt new functions in order to produce well-educated, confident and powerful young people who can generate revenue for their countries as indicated by Castells (2007) and Lundall and Howell (2000:43). These will be learners who are capable of working in the networked society which is controlled and determined by ICTs. This view of the teacher is taken further by enthusiasts of ICT in education (Nyambane and Nzuki, 2014:4; Hunde and Tacconi, 2013:708; UNESCO, 2012:7; Tedla, 2012: 202; Dede, 2008:7; Hennessy et al., 2010:40) when stating that teachers are important agents for the transformation of education and are seen as key to the integration of ICTs in the curriculum.

Hennessy et al. (2010) maintain that the relevance of the teacher in the 21st century is determined by teachers' willingness to develop and use ICTs to enhance learning. Shan Fu (2013: 116) further states that it is imperative for teachers in the 21st century to learn new teaching strategies to accommodate learners with different potential, to conduct their activities from a learner-centered perspective and integrate ICTs to create challenging and rewarding lessons. In order to be successful in ICT integration, teachers are expected to have various competencies regarding content and pedagogy such as collaboration and networking, technical issues such as infrastructure, access and technical assistance and social issues which involve ethics and policy (Akbulut et al., 2011:175).

The mastery of ICT competency means that teachers are capacitated to develop new strategies for mediating ICT supported activities. ICTs also help teachers to change the way they teach and create a constructivist learning environment (Hennessy et al., 2010). The

beneficial use of ICTs is corroborated by Tella *et al.*, (2007:10) who indicate high ICT usage among Nigerian teachers in secondary schools. From their research, these teachers mention that ICTs make their lessons more interesting, easier, more fun for them as well as their learners, more diverse, more motivating and more enjoyable (Tella *et al.*, 2007:10).

The use of new approaches is also demanded by Malaysian students (Anderson, 2010) who reiterate that teachers should use multi-modal texts and incorporate a variety of teaching methods which will be important in eliciting the qualities and skills of the third millennium. Research findings (Tziafetas, Avgerinos and Tsampika, 2013:207; Mwalongo, 2011:37-45; Akbulut *et al.*, 2011:176; Gulbahar and Guven, 2008:37) reveal that teachers' successful implementation of ICT is influenced to a great extent by their positive attitudes towards ICT, teacher's comfort with computers, beliefs supporting the use of ICTs, training, motivation and teaching efficacy. Anderson (2010:106), Redecker *et al.*, (2010:9) and SAIDE (2005:20) further stipulate that ICT potentials and benefits are easily realised in the hands of good teachers. Thus, teachers use computers and related ICTs as learning facilitators, mentors, interpreters and designers of learning programmes and materials, scholars, researchers and lifelong learners, assessors and subject specialists.

This assertion is confirmed by Hunde and Tacconi (2013:708) who say that in the knowledge era, teachers are no longer regarded as the ultimate source or fountainhead of information since technology can provide learners and students with access to an infinite amount of information. The change in the teachers' role is noticeable in the shift from the teacher as the central figure responsible for controlling and directing all aspects of learning to that of facilitator and coach (Brown, 2006; SAIDE, 2005). Contrary to the teacher's traditional role, in the new role the teacher becomes a learning facilitator, coach, collaborator, knowledge navigator and co-learner who gives learners options and responsibilities for their own learning (Kler, 2014:267). ICTs also help teachers to engage with other teachers in the same school, neighbouring schools or in other countries to form networks of learning in which they disseminate and share knowledge of their subject content and clarify issues that they may be encountering (Zaidel and Guerrero, 2008:88; Siemens, 2008:2).

In the literature reviewed, Nyambane and Nzuki (2014), Shan Fu (2013) Tedla (2012) and Dede (2008) concur regarding the teacher as the key figure and a catalyst for ensuring successful use of ICT in teaching and learning. The researcher agrees with the notion that teachers are critical in determining the successful integration of ICTs to optimise learners' creativity and the ability to build new knowledge. In spite of all the potential offered by the use of ICT in teaching and learning, the researcher maintains that ICT cannot be a substitute for the teacher. The teacher's presence is critical in guiding the learners and ensuring that set educational goals are achieved. The various social and economic backgrounds of learners and the contexts of certain South African urban and rural schools are some of the critical issues which make the presence of the teacher indispensable in the ICT resourced classroom. Therefore, the translation of ICTs into providing opportunities relies on the teachers' ability and knowledge.

Starkey (2010:22) and Siemens' (2008:4) notion of collaboration and network formation provide a platform on which more able and ICT skilled teachers help teachers with little or no ICT skills to appropriate the use of ICTs in the knowledge era. This practice can be of great importance to many South African teachers in urban and rural schools who have ICT infrastructure which is not fully utilised due to lack of skills. This argument is supported by Akbulut *et al*., (2011:176) who state that modeling of ICT by mentors or the more knowledgeable persons, providing support and sharing knowledge and experiences have an impact on the professional development of teachers regarding successful adoption of ICTs. In this way the CoL forums encourage teachers as learners to participate and connect with others with similar interests to allow sharing and to gain more knowledge (Starkey, 2010:22). These networks also update teachers on current issues and such enrichments help teachers to keep up with developments. This assertion is confirmed by Namibian teachers (Adamson, 2013:2) who note that teachers become part of the world of information and connect with other teachers across the globe.

The researcher agrees with the formation of networks and community of learning platforms because this can benefit many South African teachers who were inadequately trained in pre-service training. Such interactions empower teachers with skills and competencies required for teaching the net-generation of learners who prefer ICT based activities.

These networks also have the potential to foster a positive attitude for the implementation of new ICTs for improving teaching and learning. Therefore, it is imperative for subject advisors in the South African education system to encourage teachers to participate in such forums to inculcate the culture of using ICTs for pedagogical and personal growth and to promote a shared understanding of contentious issues. Mlitwa and Nonyane (2008:3) assert that networked technology and forums have the capacity to enable teachers to interact with colleagues anywhere in the world for mutual support and development. In the same vein Bladergroen *et al.*, (2012:113) found that teachers rely on a trainer or their peers for support and their professional development. DBE (2007:5) refers to the notion of whole-school development and puts more emphasis on the development of a community of practice to support one another to develop the essential ICT skills for individual benefit and for pedagogical purposes.

ICTs further afford teachers the opportunity to access resources and information that allow them to focus more on teaching rather than planning. Consequently, ICTs are perceived as very useful and teachers state that teaching is made easier and they are provided with various ICT tools which can be used in any form of pedagogy preferred (Nyambane and Nzuki, 2014:13). Researchers (Mooketsi and Chigona, 2014:8; Hennessy *et al.*, 2010:49) link low proficiency in teachers' use of ICTs and resentment of ICT integration in teaching and learning with the fear of embarrassment in front of their ICT capable learners. In order to gain the necessary confidence, teachers mentioned the need to be educated on the specific use of ICT as teaching methods so that all teachers could appropriate ICT usage across the curriculum. Ndlovu and Lawrence (2012:16) reiterate that teachers have to be familiar with the technologies at their disposal and should adapt their instructional strategies to enhance learning. This is important in schools where the majority of teachers are not convinced about the usefulness of ICTs in teaching and learning. Authentic demonstrations and effective training are indeed a prerequisite which can be used to assist the older generation of teachers.

Digital era learners require teachers to use multimodal texts and incorporate a variety of teaching methods. In order to be able to facilitate learning using a variety of teaching methods with ICTs, teachers are expected to portray a positive attitude towards ICT, be

comfortable with computers and support the use of ICTs as instructional tools (Akbulut *el al.,* 2011:176). Training, motivation and teaching efficacy as factors that facilitate the use of ICTs in teaching and learning (Akbulut *et al.,* 2011:176). In agreeing with Akbulut *et al.,* (2011:176), Laaria (2013a:3) and Ouma *et al.,* (2013:1) maintain that the perceptions of school leaders and teachers play an important role in ICT implementation in teaching and learning. As a result strong leadership, commitment and perseverance of those involved, high levels of technical and pedagogical knowledge and skills are conditions that facilitate the implementation of education technology innovation. However, despite the successes and the educational benefits afforded by ICTs, there are factors identified as hindrances to the implementation of ICTs for enhancing teaching and learning, and they will be discussed next.

3.7 FACTORS PREVENTING TEACHERS FROM USING ICTs IN THEIR TEACHING

Research studies (Mac Callum, Jeffrey and Kinshuk, 2014:150; Mooeketsi and Chigona, 2014:7; Ndlovu and Lawrence, 2012:5; Koehler and Mishra, 2009:62) indicate that teachers are either under-utilising ICT or not implementing ICTs at all in their teaching, and provide reasons why teachers are reluctant to use ICTs. Similar findings are expressed by Sipilä (2014:238) regarding ICT use in Finnish schools where he maintains ICT adoption and use in teaching and learning is not yet at the level it should be. This state of affairs is due to the fact that some Finnish teachers do not have the necessary digital literacy and do not know how to integrate ICT into their teaching strategies and learning methods. This is problematic in that the schools in Finland do not know what to do as institutions (Sipilä, 2014:238). From these findings it can be inferred that schools lack ICT policies and vision, have insufficient ICT skills and the school leadership lacks vision in terms of ICT and its value in education.

Mac Callum *et al.,* (2014:144) postulate that beliefs held by teachers, ICT anxiety and lack of digital literacy impact the adoption of ICTs in teaching and learning situations. Chigona and Chigona (2010:3) reveal that the reluctance emanates from a lack of confidence among teachers in using ICT for teaching their subject content. These obstacles are evident due to the fact that many computers in many ICT resourced schools are covered with dust simply because school principals and teachers do not know what to do with these tools (Mlitwa

and Koranteng, 2013:9). Various research findings (Ndlovu and Lawrence, 2012:2; Hennessy, Ruthven and Brindley, 2010:5) further report that teachers are not using ICTs to their fullest potential to transform their traditional pedagogical practices to bring about ICT educational settings due to these barriers. If the perceived value of ICT integration is not clear to teachers, they are likely to continue using conventional methods. Hennessy *et al*., (2010:23) indicate that some teachers are not impressed with the implementation of computers since activities such as shared group reading in class, hands-on experience in practical science lessons are better dealt with through the traditional teaching methods.

Similar findings (Makgato, 2012:108) confirm that many computers in South African urban schools are locked in storerooms or used for administrative purposes and there is little use of ICTs in teaching and learning. Limited use of ICTs in teaching and learning processes is attributable to a number of factors which are categorised as school characteristics and teacher characteristics (Tedla, 2012). The teacher-related factors, also known as first order barriers include variables such as attitudes, confidence, beliefs, age, gender, resistance, individual's educational level, personal experience and awareness (Ndibalema, 2014:2; Ahmad, 2011:2; Afshari, Bakar, Luan, Samah and Fooi, 2009:79).

Lack of instructional time, lack of access to ICT resources, inadequate ICT infrastructure, lack of effective training, inappropriate organisation, technical problems, lack of vision and mission about the significance of ICT in teaching and learning and poor leadership are characterised as school-level barriers (Greer, Koran and White, 2016:2050; Afshari *et al*., 2009:81). Although all these variables affect the adoption and inclusion of ICTs in teaching and learning, it is teacher-related characteristics that outweigh school characteristics as they are said to be an important influence on the uptake of technology to enhance teaching and learning. This is based on the assumption that teachers are key figures in determining the successful use of ICT in the learning milieu.

The effective use of ICT in schools in developing continents such as South America and Africa is affected by barriers which include lack of access to computers in working condition, lack of software and technical support, insufficient teacher training, lack of internet access, lack of reliable electricity supply and lack of parent and community

involvement (Hart and Laher, 2015:2; Tedla, 2012:203; Mwalongo, 2011:39; Hennessy *et al.,* 2010:40). Afshari *et al.,* (2009:82) point to the lack of parental involvement as another factor that impedes ICT integration at school.

The same factors are pointed out by Laaria (2013b:16), Tziafetas *et al.,* (2013:200) who identify the cost of ICT tools, inadequate infrastructure and poor maintenance, obsolete and problematic ICT equipment, inadequate and poorly trained teachers on ICT use, limited and unreliable sources of power, negative teacher attitudes towards computers, lack of knowledge, insufficient number of computers and ICT infrastructure, dissatisfaction with the introduction of ICTs in education and teachers' lack of confidence as major factors which hinder the implementation of ICTs in schools. Insufficient funds, insufficient numbers of computers, lack of computer literacy among teachers, lack of subject teachers with training on how to integrate computers into specific learning areas are also mentioned by Anderson (2010, 84-85). Akbulut *et al.,* (2011:176) found that poor classroom environments and lack or limited availability of ICT equipment are significant factors in preventing ICT integration in teaching and learning. In some schools, the access to ICT infrastructure does not constitute a challenge. However, insufficient ICT knowledge and lack of technical support are issues that hinder teachers' readiness to integrate ICT in their teaching (Tella *et al.,* 2007:10).

UNESCO (2012:7) attributes the problem to lack of communication and leadership between macro-, meso- and micro levels in education. This lack of communication leads to limited access to ICTs in schools, problems with tuning ICT-enhanced learning environments with the curriculum, lack of a shared vision at the school level and insufficient ICT integration competencies of teachers. Chigona *et al.,* (2014:3) contend that challenges which prevent schools from using computers as teaching and learning tools include lack of teacher confidence, lack of teacher competence, resistance to change, and negative attitudes which are teacher-level barriers. Under school-level barriers, Greer *et al.,* (2016:2050) and Bingimlas (2009:237) cite lack of time, lack of effective training and lack of support as external issues preventing teachers from integrating and implementing ICTs. In addition to the above mentioned factors, Mdlongwa (2012:4) refers to the fear of change as a major challenge that breeds lack of confidence in teachers in many South African public schools.

In the reviewed literature (Ouma *et al.*, 2013:2; Doyle and Reading, 2012:1), it is indisputable that teachers are critical human resources on whom the success of ICT usage in teaching and learning depends. The researcher is in agreement that with ICT teachers are empowered to conduct individual learning. ICTs also provide teachers with teaching strategies which facilitate new ways of teaching which are in contrast to the traditional methods. However, the infrequent or non-use of computers creates an educational obstacle. According to the researcher, it is imperative that teachers acquire ICT skills in order to use computers and other related ICTs to achieve the educational goals established for ICT usage in teaching and learning. The formation of networks and communities of learning which are grounded in connectivism as discussed in section 2. 5. 3, can enable frequent and ICT skilled teachers to share and help teachers with limited ICT knowledge. The sooner all teachers start using ICTs in their pedagogical activities, the more experienced and confident they will become. Knowledge gives power as elicited by Castell (2007) and in this case it provides the ability to use technologies that are relevant to teaching. Teachers must accept their responsibilities and guide learners to achieve their potential and educational goals. The use of advisors and the technical support is of utmost importance in enabling teachers to cope and overcome ICT challenges.

Contrary to conditions that impact ICT use negatively, there are factors that contribute to the uptake and appropriation of ICT use in teaching and learning classrooms. These factors are discussed in the next section.

3.8   FACTORS CONTRIBUTING TO ICT USE IN TEACHING AND LEARNING

Previous research (Msila, 2015:1976; Ndibalema, 2014:11, Ouma *et al.*, 2013:2; Tedla, 2012:202) found that ICT is highly regarded as an effective pedagogical tool to transform teaching and learning and help all learners to achieve their learning potential and for meeting the 21st century skills. The uptake and appropriation of ICTs in schools by teachers is determined by a number of factors which include staff development in terms of empowering them with technological skills, affording them with new methods of teaching, collaborative working, access to the internet and other ICT tools, interaction with learners, self-motivation, positive attitude, support from the school leadership (Ouma, *et al.*, 2013:1;

Tella *et al*., 2007:6; 2008:3, Tedla, 2012:202). All stated factors that contribute to ICT use in teaching and learning are conditions that are a reality in many South African teaching and learning contexts. Adequate awareness of the potential of ICT in teaching and learning is a prerequisite to make teachers aware of conditions at their disposal that can lead to effective use of ICTs in the educational situation. However, ICT use in many schools is hampered by several conditions which are illustrated in the next section.

3.9 CONCLUSION

This chapter reviewed the literature on the role of ICTs in teaching and learning with emphasis on its potential to transform the education terrain in order to produce ICT capable learners. It focused on the description of the ICT concept, ICT in education policy, use of ICTs in education in well-resourced countries and in developing countries. ICT policy is foundation for the innovative use of ICT but it requires careful planning and preparation so that all prerequisites are in place for the integration of ICT to be successful. The chapter highlighted the affordances brought about by ICT in learning and teaching and the role of the school principal as an ICT leader. The factors that impede or encourage ICT use were investigated. These are issues that are of great importance in enabling the researcher of this study to answer the research questions posed in Chapter 1.

The next chapter will focus on the research methodology which the researcher has used in the investigation of teachers' use of ICT.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.1   INTRODUCTION

The previous chapter highlighted the literature that supports the introduction and the integration of ICTs in knowledge society school systems throughout the world. This chapter describes, discusses and justifies the research design and methodology used in the study, focusing on the description of the research paradigm, the approach, design and data collection techniques used to build an in-depth understanding of teachers' use of ICTs in teaching and learning in Gauteng urban schools. The issues of credibility and trustworthiness as well as ethical considerations are also taken into consideration so that the results can be accepted as meaningful contributions for resolving the research issue and for use by other researchers.

4.2   THE RESEARCH PARADIGM

According to Babbie (2010:33) a paradigm is a fundamental model or frame of reference used to organise observations and reasoning. De Vos *et al.*, (2011:513) define a paradigm as a pattern containing a set of legitimised assumptions and a design for collecting and interpreting data. Guba and Lincoln (1994:107) maintain that a paradigm is a set of basic beliefs that deal with ultimates or first principles, and these basic beliefs are accepted without questioning. As basic beliefs and by virtue of being grounded in peoples' philosophies, these paradigms are based on ontological, epistemological and methodological assumptions that play a major role in the researcher's paradigmatic view.

Ontological questions are concerned with the nature of existence, of what there is, the general features of what there is and reality. Epistemology poses the questions of how reality can be known; the relationship between the knower and what can be known; the principles that guide the process of knowing; and the possibility of the process being shared or repeated by others to assess the quality of research and the reliability of

research findings (Vasilachis de Gialdino, 2009:2). Methodological questions focus on how the inquirer can go about finding out what can be known.

McMillan and Schumacher (2010:5) identify positivism, interpretivism and critical theory as the basic research paradigms which researchers bring to research. According to these authors and Nieuwenhuis (2007:55), positivism emphasises the rationalistic view of knowledge which can be discovered only through scientific methods. This paradigm maintains that humans must be studied in the same way as nature is studied and as such, scientific knowledge is regarded as fact. The emphasis on a single reality results in disregarding social interaction as a source of knowledge construction. In the critical paradigm people understand how society functions and the methods by which unsatisfactory aspects can be changed. Interpretivism stands in opposition to positivism and maintains that there are many truths and multiple realities due to the fact that external reality is variable. The interpretivist approach provides the participants with the opportunity to raise their voices, concerns and practices in order to be heard and at the same time enables the researchers to get insight and in-depth information (Thanh and Thanh, 2015:26).

Critical theory shares characteristics with interpretivism by focusing on studying and understanding society but it puts more emphasis on reason as the highest potential in human beings and through reasoning people are enabled to criticise, challenge and change the nature of a society (De Vos *et al.*, 2011:9). The network society theoretical framework which underpins this study is the critical theory in that it highlights the weaknesses of the schooling system which rely on a teacher-centred approach, traditional pedagogic methods, and educational outcomes which focus on producing passive learners. In contrast, critical theory advocates a change in the schooling system that embraces ICT integration across the curriculum to produce active, creative, critical thinkers, problem-solvers with ICT skills required for personal, social and economic growth in the globalised world. The new social dispensation requires teachers and school communities to change their attitudes and embrace a climate change in education brought about by the inclusion of ICT as one of the important ingredients for effective teaching and learning. The three

research paragims are summarised in the table below which was generated from the information pertaining to each paradigm.

Table 4.1: Summary of the four main research paradigms

Characteristic	Positivism	Interpretivism	Critical theory
Ontology	The reality to be studied and understood is out there.	Realities are apprehendable in the form of multiple, intangible mental constructions. The realities are socially and experientially based.	Objective reality and believes that there is a true consciousness out there. The task of the critical theorist is to raise people to a level of true consciousness.
Epistemology	Rationalistic view of knowledge; knower is distinct from the known.	Knowledge is socially constructed. The researcher and participant interact in the attribution of meaning.	Reason is the highest potential in human beings. Subjectivity as inquiry acts are intimately related to the inquirer's values. People use reasoning to criticise, challenge and change the nature of a society.
Methodology	Quantitative: Experiments, quasi experiments, surveys, correlational studies. Hypothesis.	Qualitative: Dialogic and dialectical, systemic procedures.	Qualitative : Encourages participants to be free and to give their perspectives of their own situation and the world they live in.
Beliefs	One truth, objective.	Many truths, multiple realities, different people have different	Features of the real world are apprehended. False

		experiences.	consciousness and oppression of the people are exposed. People act in order to transform their environment and their world.
Products	Facts, theories, rigid rules, laws and predictions.	Narratives, interpretations, reconstructions.	Dialogue, active participation, judgements, transformation.

This study is rooted in the interpretivist paradigm as it is more concerned about uncovering and explaining teachers' experiences, perceptions and attitudes on ICT usage in teaching and learning in the school environment. The study subscribes to the critical approach in that it challenges and critiques the current schooling system in which teachers, school leadership and learners do not embrace ICT to enable transformation required for the development of basic skills, the foundation of new knowledge and the establishment and realisation of the knowledge society. It is the researcher's view that the need to have TPACK teachers is gaining momentum in order to ensure that learners are both ICT and information literate and have the social and relational skills which are indispensable for participation as learners, workers and citizens in a knowledge-based society (Butcher, 2011:13). The benefits of ICT integration in the schooling system are also viewed in terms of cost reduction, time saving and efficient administration of teaching and learning activities. From the critical approach stance, ICT is a technique to enable knowledge acquiring, dissemination and sharing with anyone, everywhere and at the convenience of the individual. The critical approach is vital for the South African education system in terms of ICT usage to improve educational quality, provide equitable education for all, and have well trained and knowledgeable teachers who accept the responsibility of producing educated learners, workers and citizens for the knowledge society.

The various subjective meanings attributed to ICT usage in teaching and learning are of great importance as they paint a picture of social reality in terms of ICT implementation. The study therefore focuses on an in-depth understanding of the use of ICTs in daily school activities of teachers and learners. The researcher's intention is to give a hearing to participants' voices and make interpretations which will indicate the truths and realities in terms of ICT integration in South African urban schools.

4.3   RESEARCH APPROACH

Yin (2009:26) defines a research approach as a logical plan for getting from *here* to *there*, where *here* is considered as the initial set of questions to be answered, and *there* is a set of answers to the questions. Methodology is defined by Tuli (2010:102) as a research strategy that translates ontological and epistemological assumptions into guidelines that indicate how research is to be conducted. McMillan and Schumacher (2010:21) also define methodology as the procedures used in conducting a study.

The nature of the research problem dictates the research methodology which the researcher must use in order to obtain the information necessary to answer the main research questions and the subsequent questions. The research purposes can be achieved by using any of the three research approaches typified by McMillan and Schumacher (2010:11) and Ivankova, Creswell and Clark (2007:263) as follows:

1.   A quantitative approach emphasises objectivity in measuring and describing a phenomenon. In this inquiry the quantitative researcher follows a logical model in which specific expectations according to the hypothesis formulated are developed. The focus is on numerical data rather than the views and utterances made by the research participants.

2.   A qualitative approach focuses on non-numerical data and the research information is gathered from occurring phenomena. In a qualitative inquiry the researcher focuses on establishing the meaning of a phenomenon by using the participants' experiences and views.

3.   A mixed method approach combines quantitative and qualitative methods with the intention of producing a more comprehensive investigation. One of the advantages of employing a mixed method approach is that the researcher can demonstrate the research findings quantitatively and also explain why such results were found.

In this study a qualitative approach is used as it is interpretive, rigorous, reflexive and deep in nature (Mortari, 2015:5). Another reason for using the qualitative research approach is that the researcher is concerned with the explanations and the descriptions of ICT usage from the perspective of the practitioners rather than from people who are outsiders. In addition to this assumption, teacher participants are familiar with ICT contexts in school; they have content knowledge, pedagogical knowledge and varying levels of the technological knowledge, and therefore could be probed to express what they feel and know regarding ICT usage at their schools. Through such interactions, the researcher was afforded the opportunity to gain an in-depth understanding of teachers' experiences and perspectives on their social reality of ICT usage in the schooling system.

4.4   RESEARCH DESIGN

McMillan and Schumacher (2010:20) describe research design as procedures for conducting the study. Therefore the aim of a research design is to specify a plan to enable the researcher to generate empirical evidence that will be used in answering the research questions. The single case study research design is employed in this research study as individual teachers and principals are pedagogical practitioners engaged in the teaching and learning settings where ICTs are used to raise the educational levels and improve the quality of education in general to comply with the requirements of the 21st century and the knowledge society. The case studies are also considered by the researcher as natural sources for the provision of data and the social truths pertaining to ICT integration in their school contexts. This is attested to by Yin (2009) who states that a case study investigates a contemporary phenomenon within its real life context. The case study also helped the researcher to gain various perspectives, more information and to generate more conclusions rather than relying on information coming from a single case.

4.5   CHOICE OF THE RESEARCH PROBLEM

The choice of the research problem for this study emanates from the modern trend which endorses the use of ICTs in knowledge societies' schooling systems. Globalisation and the prevalence of ICTs require teachers to improve their teaching strategies to benefit their learners by using ICTs as an additional teaching method. The present-day learner is expected to meet 21st century skills which emphasise critical thinking, creativity, knowledge sharing and cooperative learning in order to become knowledgeable and fully fledged citizens who are prepared for their future jobs and careers (Mdlongwa, 2012:5; Saavedra and Opfer, 2012:4).

The research problem also originated from the stipulations of the South African ICT educational policy and the 'new' role of the teachers in using ICTs across the curriculum (DBE, 2007:19). The establishment of ICT infrastructures and computer laboratories in urban schools, the roll-out of tablet computers with embedded educational software and internet connectivity, the aspiration to make all Gauteng schools paperless schools, and the desire to be able to compete with the best countries in the world are significant aspects in the formulation of the research problem. Teachers are expected by the DBE and GDE in particular to perform multiple tasks including the use of technology to increase their productivity and to improve learners' learning experience. Despite ICT infrastructures being established in various South African urban schools, the effective use of ICTs across the curriculum by teachers and learners is not realised. Van Wyk (2014:4) and Ford and Botha (2014:4) confirm the under-utilisation of ICT resources in South African public schools to the detriment of transforming teaching and learning. The under-utilisation is attributed to various external and internal factors as indicated in section 3.7. However, teachers as the facilitators should be the ones to ensure the successful use of technology for teaching and learning. As a result in schooling contexts where ICTs are not benefitting pedagogic practices, teachers should be scrutinised in order to remedy the situation and ensure effective use by both teachers and learners.

4.6   THE ROLE OF THE RESEARCHER

The researcher's role in this study consisted of executing various responsibilities. Firstly the researcher was a key instrument in the collection and the analysis of data. The researcher's presence in administering the interviews ensured that the participants answered all the questions as required. The second responsibility was guarding against the researcher's personal assumptions and avoiding biases when eliciting relevant responses. In some instances, the researcher was asked to clarify issues which were done without leading participants to give specifically desired responses. This was due to the fact that, as a qualitative researcher, the researcher was aware of the problem of leading questions and answers which would ultimately result in biased findings. The researcher's goal therefore was to prevent this from happening.

The third crucial role the researcher played in this study was to establish a rapport with the participants. This helped in developing trust and created an atmosphere in which all participants felt free and willing to open up and provide honest answers. The relationship with the participants enabled the researcher to interact with the participants three times and use telephonic conversations in cases where it was not possible to meet the participants for follow-up interviews.

4.7   POPULATION AND SAMPLE

According to Babbie (2010:199), population refers to the group or the collection researchers are interested in generalizing about. The study population is the aggregation of elements from which the sample is selected and every element with the same characteristics has the chance to be selected for the sample. The population in this study is regarded as the "target population", and it is the set of elements that the researcher focuses upon.

A sample is a subset of the population considered for inclusion in the study (De Vos *et al.*, 2011: 224). Qualitative sampling is an act of selecting information-rich cases for in-depth study in order to understand something about the cases without needing or desiring to

generalise to all such cases (McMillan and Schumacher, 2010: 325). The informants were chosen by the researcher because they were likely to be knowledgeable and informative about the phenomenon under investigation. Qualitative sampling also increases the utility of information gathered from small samples. Another significant feature of qualitative sampling is that a few cases studied in depth yield many insights about the topic.

Based on the purpose and objectives of the study, the researcher used purposive sampling in selecting the research participants who provided the required information due to the fact that their schools are resourced with ICTs. In addition to this, the national policy prescribes the integration of ICTs across the school curriculum. The sample consisted of five primary school teachers, five high school teachers, three primary school principals and two high school principals. Although the sample is small, it represents schools in the township context of this research as all are under the same jurisdiction. The teacher participants shared their experiences regarding the use of ICTs in the classroom following the ICT in education policy. The principal participants were engaged in the study on account of their roles as transformation and ICT leaders at the various schools. The principals' ICT transformational leadership role is entrusted to them by virtue of having ICT infrastructures at their schools as inferred by Afshari *et al*., (2012:281). All participants were approached to be involved in the study to strengthen the multi-case methodology.

Other criteria that contributed to choosing teacher and principal participants are as follows:

1.   Proximity of the schools to the researcher;
2.   Availability of ICT infrastructure at the school;
3.   Training that teachers received on the integration of ICTs in their teaching responsibilities; and
4.   Some schools in partnership with independent schools in Pretoria where ICTs are used on a daily basis by the principals, teachers and learners to raise the level of education.

The study took place in Mamelodi Township schools which are under the jurisdiction of the Tshwane South District in the Gauteng Department of Education. Mamelodi is a township in

the eastern side of Tshwane Metropolitan in Gauteng and is populated by black people. The schools found in this area are non-school fee paying schools and are totally dependent on the government for funds.

4.8   DATA COLLECTION

The explanations and descriptions provided by the research participants are various means for providing the information to the researcher in order to develop credible answers to the main research question. Strategies for collecting data such as observation, interviews and documents, enable the researchers to collect data deemed relevant for the phenomenon under investigation (Nieuwenhuis, 2007:81).

In this study the semi-structured interview, non-participant observation and document analysis were data collection strategies used to gather relevant data for answering the research questions. The semi-structured interview was the information collection technique used to interview the teachers and principal participants as individuals on a one-to-one basis. The semi-structured interview was chosen because, by its nature, it gave teachers and principals the freedom to answer questions in any way they deemed fit which also provided a bank of comprehensive and comparable data. In this study teachers were asked the same questions and more probing, clarifying and follow-up questions were added in order to get more information in cases where the participants were reluctant to give honest answers or where the researcher thought there was some misunderstanding of the interview questions.

The interviews (See Appendices G and H) with all the participants were conducted after school hours and lasted for about 45 minutes. The reason for conducting the interviews after school hours was due to the fact that the researcher did not want to interrupt the teaching and learning process. The interviews with principals were shorter and lasted for about 30 minutes. Principals also indicated that after school was the ideal time for them because as school leaders they have many responsibilities and could not accommodate interviews unless it was an appointment with authorities from the Department of Education.

In conducting the interviews the researcher used iterative questions for emphasis and to check validity of the responses provided by the participants. As indicated by Babbie (2010:277), this probing technique helped the participants to elaborate on their answers and to provide the sufficient information needed for resolving the research problem. This particular strategy was chosen because it prompted an in-depth verbal description of the phenomenon of ICT usage in the urban schools and allowed for further probing. As part of active interviewing, the participants had the choice to answer the questions they wished to respond to at the various stages of the interview.

The researcher used an audio recorder to ensure that the interviews were captured and used a journal to write notes of issues deemed to be important. Some participants provided critical information regarding their views on ICT usage at their schools even when the recorder was switched off. It also became evident to the researcher that although the participants were informed of the permission granted by the DBE and GDE to conduct the research and were assured of anonymity, privacy and confidentiality, there were instances where some participants preferred not to be recorded for fear of being victimised. Acknowledging the participants' fears, the researcher took notes of every utterance that was not recorded.

The second data collection strategy used in this research endeavour was non-participant observation which is described as the data collection technique in which the researcher as a complete observer watches the participants without actively taking part in the research situation (Nieuwenhuis, 2007:85). In this study the non-participation observation was carried out before, during and after the interview sessions and the phenomena for observation were the physical attributes of the computer laboratories, how ICT was used and the behaviour of the participants and the learners while in the computer classroom. The intention of the observation was to supplement the information provided by the participants, to get credible information with regard to ICT usage in schools and to validate the empirical findings.

Document analysis was the third data collection strategy used to study and evaluate existing documents to understand the substantive content or to illuminate deeper

meanings about the phenomenon being investigated (De Vos *et al*., 2011:377). Document analysis enabled the researcher to get more information from various documents pertaining to ICT usage in education for enhancing teaching and learning in South African schools. According to De Vos *et al*., (2011:377) and Niewenhuis (2007:101), documents are regarded as rich sources of information which help researchers identify important information that assists in understanding the research data. As a result content analysis requires the researcher to scrutinise the content in order to find the desired information and to triangulate it with information found by the other data collection techniques.

The use of document analysis is ideal in instances where some topics are not appropriately addressed by any other method of inquiry. In this study the documents for scrutiny included the ICT education policy documents, guidelines for schools ICT hardware specifications, GDE strategic solutions, newspaper articles and reports on ICT usage in South African schools. In the current study the documents provided the researcher with official information regarding the introduction of ICT use in all Gauteng schools.

The use of non-participation observation, semi-structured interviews and document analysis helped in the triangulation of data collection methods with the aim of getting the most sought and relevant information. The information and the behaviour that was not verbally conveyed by the participants was captured through the researcher's observation and the observation provided essential information to facilitate a deeper understanding of teachers' experience of ICT usage in their daily teaching and learning activities. The observations made were recorded in the researcher's journal for the purpose of triangulating findings. The data collection phase was followed by data analysis processes although the two processes are interrelated and cyclical.

4.9   DATA ANALYSIS

Data obtained by means of any data collection strategies has to be examined and analysed in order for the researcher to gain a better understanding of the information, to fully describe and attribute meaning with the intention of developing credible conclusions appropriate for answering the research questions. Therefore data analysis is defined by

Hashemnezhad (2015:60), Leedy and Ormrod (2005:150) as a process of analysing data and interpreting the results. Babbie (2007:378) defines data analysis as the non-numerical examination and interpretation of observations for the purpose of discovering underlying meanings and patterns of relationships. According to Creswell (2007:46 and 150) qualitative data analysis is an ongoing and interactive process which implies that data collection, processing, analysis and reporting are intertwined. At this research stage the masses of data are broken down into smaller units and then reassembled to call attention to patterns, themes and concepts (Bradley, 1993:443). The researcher therefore engages in interpreting, consolidating and reducing what people have expressed in order to attribute meaning. In analysing data, the researcher followed the method as proposed by McMillan and Schumacher (2010:367), using a systemic process of coding, categorization and interpretation. Data coding is one of the steps in data analysis and is defined as a process which involves data reduction and the identification of small pieces of data, or manageable sets of themes that stand alone and can be used to identify and label relevant topics of data (McMillan and Schumacher 2010: 370; De Vos *et al.,* 2011:411). In this study although the transcription of the recorded data was done by an expert, the researcher listened to the recorded interviews several times for an in-depth understanding and to be able to interpret and attribute meaning to the various utterances of the research participants. The handwritten data from some participants, who were unable to be interviewed due to unforeseen circumstances, were captured for analysis.

The coding system was preceded by the organisation of data and later followed by colour coding of data segments to indicate the various categories as well as the overlapping categories. As explained by Creswell (2010:105), descriptive words or identifying names in this study were used in segments that were of significant importance to the research question and the research aims. Similar codes were also grouped together in order to allow themes to emerge. The coding exercise is inductive in nature and allowed the themes to emerge from the grouped codes.

The subsequent stage involved the categorisation or the grouping of similar issues to form categories. In this study it was discovered that some codes fitted in more than one category. Another important goal of qualitative research according to McMillan and

Schumacher (2010:379) is to discover the relationship between the categories that allow patterns or themes to emerge from data. The analysis involved the inductive mode of thinking which moves from the particular to the general. These patterns were used to develop a report of the research findings.

In the whole analysis process the researcher used inductive data analysis in the empirical investigation as well as deductive data analysis in terms of document analysis. These analytical exercises helped the researcher in the triangulation of findings by using the categories and themes that emerged through the inductive analysis to test, compare, verify and illuminate the findings that were found in the former analysis as discussed in chapter 5.

4.10   TRUSTWORTHINESS IN DATA COLLECTION AND ANALYSIS

In qualitative research trustworthiness is very important; therefore every qualitative researcher is obliged to ensure that the research findings are credible and trustworthy so that they can be interpreted, applied in the field and benefit researchers and other interested parties. Validity in qualitative research refers to the degree of congruence between the explanation of the phenomenon and the realities of the world (McMillan and Schumacher, 2010:330). Qualitative researchers such as Given *et al*., (2014:9), Lincoln and Guba (in Shenton, 2004:64) posit that validity assumptions applicable in the naturalistic paradigm are inappropriate for evaluating qualitative research and proposed four trustworthiness criteria which include credibility, transferability, dependability and confirmability. These criteria and their peculiar activities are discussed next.

4.10.1   Credibility

Credibility is described as the truth value and it deals with the question, "How congruent are the findings with reality?" (Shenton, 2004:64). This criterion refers to the representation of the construction of the social world under study and is assessed in terms of the process used in eliciting those representations in terms of the credibility of those representations for the community under scrutiny (Shenton, 2004:64; Bradley, 1993:437). According to Yin (2011:19), credibility demonstrates that the subject has been accurately

identified and described, and that the research was conducted in a publicly accessible manner. Leedy and Ormrod (2005:100) further identify a prolonged stay in the field, triangulation of different methods, feedback from others and member checking as activities that increase the credibility of qualitative research.

The credibility activities adhered to in this study are utilisation of well-established research methods, selection of participants to provide relevant information to answer the research questions, preliminary visits, pilot testing, iterative questioning, member checking and triangulation. The criteria and their peculiar activities are discussed in the subsequent paragraph.

4.10.1.1   Utilisation of well-established research methods

With reference to credibility in terms of the investigation of teachers' perspectives regarding ICT usage in schools, the researcher ensured that the literature study, the interview protocol and document analysis as well as established research methods were adopted for data gathering. Regarding the interview schedule, the researcher used an interview protocol and asked research participants the same questions.

4.10.1.2 Purposive sampling of participants

The purposive sampling procedure was deliberately chosen for this study and teachers and principals who have ICT infrastructure at their schools and to a certain extent use these ICTs for teaching and learning were selected to participate in the study. The unique experiences of every participant were relevant in providing rich information. In addition, the data that the teacher and principal participants provided was considered by the researcher to be suitable and relevant in providing answers to the research questions.

4.10.1.3   Preliminary visits

The researcher paid each research participant two preliminary visits in order to create a relaxed atmosphere, develop familiarity with the participants and establish a relationship of

trust. The preliminary visits also served the purpose of briefly explaining to the participants the researcher's intention in regard to doctoral studies and the significance of each participant in the study. The participants were also informed of the researcher intention to record the interviews and it was clarified that the interviews will not be recorded should the participant wishes so. Anonymity and voluntary participation were also emphasised. The rapport that developed was also aimed at making participants feel free to voice their experiences regarding the ICT contexts at their schools without reservations.

4.10.1.4 Pilot testing

Pilot tests are used to determine whether the intervention will work and are implemented in situations which are convenient for researchers (De Vos *et al*., 2011: 195). Through this procedure the researcher is able to identify the elements of the prototype which need amendments. In pilot testing the researcher will be reassured if the interview questions achieve what they are meant to, in which case it is maintained that pilot tests help to determine their effectiveness.

In this study to ensure credibility and trustworthiness the researcher piloted the provisional interview schedule with one high school teacher and one primary school teacher in order to ascertain whether the questions were clear and sequenced in a manner that would elicit the information that would help in answering the main research question and the subsidiary questions. During the pilot interviews it emerged that teachers had problems with question 7 which focused on application software and question 20 on policy issues regarding the use of ICTs in schools (See Appendices G and H). As these questions were vital for obtaining the required data, the researcher then explained to the participants the terms which gave them the opportunity to open up and provide their perspectives. This experience showed the researcher how to approach these questions when interviewing the selected teachers and principal participants. These challenges made it evident that some issues pertaining to teachers needed to be clarified.

4.10.1.5   Iterative questioning

Iteration is described by Srivastava and Hopwood (2009:76) as a reflexive process geared to sparking insight and meaning development. Reflexive iteration enables the researcher to visit and revisit data, connecting the data with emerging insights which eventually lead to refined focus and deeper understanding. Iterative questioning was used in this study to verify the responses which were provided by the participants. The researcher posed the same question several times in order to compare the responses for consistency.

4.10.1.6   Member checking

Member checking is also referred to as participant verification, informant feedback or external validity. According to Harper and Cole (2012:510), member checking is a quality control procedure which a researcher employs to improve accuracy, credibility and validity. As respondent validation, the researcher goes back to the participants after the interviews to verify if the captured records are accurate, or if they need correction or more elaboration. After the transcription of the interview data the researcher went back to the various teachers and principal participants to verify and authenticate the data as a true reflection of the conversation that took place. Teachers who were not available due to other commitments were given their transcripts and contacted telephonically to confirm or reject the captured data.   Most participants verified the information as accurate and that served as an assurance for validity. Those parts which were questioned by the participants were corrected in accordance with the participants' experiences regarding ICT use at their schools.

4.10.1.7   Triangulation

Triangulation is an approach to research that uses a combination of more than one research strategy or design in a single investigation in order to enhance confidence in the ensuing findings (De Vos *et al.,* 2011:442). In this study the researcher used methodological triangulation which refers to the use of more than one method for data gathering. The strategies used in gathering data were semi-structured interviews, non-participant

observation and document analysis. The use of various techniques enabled the researcher firstly to add richness to the inquiry and secondly to cross-check in order to enhance the credibility and the validation of the research findings.

4.10.2   Transferability

Transferability refers to the extent to which the researcher's findings can be transferred from one specific situation to another. This is a judgment that can be achieved if the researcher provides enough data through rich and ample description.

The population of this study was urban schools resourced with ICTs for teaching and learning. However, it was not possible for the researcher to conduct research in all the schools. Therefore, a sample that was representative of the schools was purposively selected based on the fact that the ICT context of the schools is similar. Consequently, the research findings were transferable to the teachers and principals who are integrating ICTs in their teaching practices.

4.10.3   Dependability

Dependability is a criterion whereby the researcher needs to account for changing conditions in the phenomenon chosen for study as well as the changes in the research design created by a refined understanding of the setting. The dependability criterion in this study will be applied by writing a detailed report for the DBE and for each research participant. The report will also create opportunities for future research especially since ICT usage in urban and rural South African schools is an issue to contend with.

4.10.4   Confirmability

Confirmability is the construct that refers to the extent to which the characteristics of the data can be confirmed by others who read or review the research results. In this study the research findings were confirmed by referring to the literature information pertaining to ICT usage outlined in Chapter 3. Confirmability was again applied by ensuring that the

findings emanate from the experiences and views of the teachers and principals who participated in the study rather than the preferences of the researcher.

Besides trustworthiness as one of the cornerstones of this research activity, the researcher heeded certain moral principles that were critical in monitoring the conduct between the research participants and the researcher. The ethical issues that were applicable in this study are discussed next.

4.11 ETHICAL ISSUES IN QUALITATIVE RESEARCH

The research process creates a tension between the aims of the research and the rights of the participants to maintain anonymity. Therefore ethics in research are concerned with beliefs and codes of conduct of what is right or wrong, what is proper or improper, what is good or bad in conducting research (Babbie, 2010:64). Ethical guidelines are therefore the standards and the basis upon which each researcher ought to evaluate their conduct and ensure that the code of principles is upheld to prevent harm. These ethical issues are defined by De Vos *et al.*, (2011:114) as a set of moral principles which are suggested by an individual or a group and are subsequently widely accepted as rules governing behaviour and conduct between research participants and researchers.

Ethical issues which are relevant in this study included ethical clearance by the University of South Africa (Unisa), obtaining permission to do research in the identified schools in Tshwane South District, informed consent, voluntary participation, anonymity, confidentiality, and debriefing of participants. Allmark, Boote, Chambers, Clarke, McDonnell, Thompson and Tod (2009: 49), Maree (2007:300) and Leedy and Ormrod (2005:101) identify confidentiality, harm, and informed consent as ethical issues that are critical in qualitative research. For the purpose of this study the following ethical standards were adhered to.

4.11.1   Ethical clearance and permission

Before embarking on the empirical investigation, the researcher obtained ethical clearance from the College of Education at the University of South Africa (Unisa) in terms of the university's research policy (See Appendix F). Unisa is the institution where the researcher is a student. Written approval to interview teachers and principals on ICT usage in schools was given by the GDE and Tshwane South District Director who informed the identified schools about the research intention.

4.11.2   Informed consent

The researcher is obliged to inform his or her participants of all possible information on the goal of the investigation, the duration of the participants' involvement, the procedures which will be followed during the course of the investigation, and the pros and cons to which respondents may be exposed to. Social researchers also maintain that the participants must be legally and psychologically competent to give consent and must be made aware that they are at liberty to withdraw at any time (Shahnazarian, Hagemann, Aburto and Rose, 2013:4).

Informed written consent is regarded as a necessary condition of the research study. The researcher should lay emphasis on accurate and complete information so that the research participants fully understand the details of the investigation and consequently are in a position to make an informed decision about their participation. By doing so the participants are also conceding to voluntary participation which implies that they are not coerced into taking part in the research study.

Informed consent was one of the main ethical considerations obtained from the participants in the study (See Appendix A). After the briefing given by the researcher, the participants knew that they had a choice of whether they wanted to participate in the research and that they had the right to withdraw from the research at any time. Through signing a written consent form, the participants indicated their understanding of the research project and consented to participate voluntarily.

4.11.3 Confidentiality

Confidentiality (Babbie, 2010: 67) refers to a situation in which the researcher promises to keep information about the respondents private. De Vos *et al*., (2011:118) also view privacy as synonymous with confidentiality and as far as they are concerned, it means to keep to oneself that which is not intended for others to observe or analyse. This ethical guideline also maintains that every individual has the right to privacy and it is his or her right to decide when, where and to whom and to what extent his or her attitudes, beliefs and behaviour will be revealed.

Information was given anonymously and voluntarily. However, in instances where participants were not at ease with being recorded, the researcher heeded the participants' requests and switched off the recorder. The names of schools involved were kept confidential. To observe this ethical condition, the participants were referred to as Teacher #1, Principal #1 although the identities and the names of the schools were well known to the researcher.

4.12 CONCLUSION

The above discussion outlined the research methodology followed in the search for an in-depth understanding of teachers' and principals' experience and perceptions of the use of ICTs in urban primary and high schools located in Mamelodi Township in the Tshwane South District. The qualitative research design and the relevant qualitative techniques for data collection were elucidated. The discussion indicated how the gathered data was analysed using the systemic process of coding, categorization and interpretation. The various measures were needed to ensure credibility and trustworthiness of the data collecting instruments as well as the data obtained. The ethical issues which are of importance to this study were also highlighted.

In Chapter 5, the analysis, interpretation and discussion of the collected data will be presented.

CHAPTER 5

DATA ANALYSIS, INTERPRETATION AND PRESENTATION OF FINDINGS

5.1   INTRODUCTION

The importance of the qualitative research design and the necessity of using a case study design for this research endeavour were highlighted in Chapter 4. The current chapter comprises two sections: data analysis and discussion of findings. The first section focuses on the analysis of data and the discussion of the empirical findings. The second section focuses on evaluation and the discussion of the analysis of various documents on ICT usage in teaching and learning. The first aspect of the empirical findings highlights the profiles of each participant. The findings are presented and supported by participants' quotations in order to answer the research questions outlined in Chapter 3. The theoretical framework in Chapter 2 and the literature review in Chapter 3 provide the foundation that supports the explanation of the collected data documented in Chapter 5 and the recommendations in Chapter 6 to ensure that the research findings are supported and anchored in the literature (Bowen, 2009:33).

Secondly, document analysis was conducted to acquire more information and to enable the triangulation of the research findings. The documents that pertain to ICT integration and usage in teaching and learning were scrutinised as secondary sources of data in order to obtain relevant information to answer the questions posed in this investigation. The deductive thematic approach was used in document analysis to triangulate and to confirm empirical findings. In this research therefore inductive as well as deductive approaches to analysis were used for the systematic review of the information and for the production of reliable and valid findings.

5.2   ANALYSIS OF EMPIRICAL DATA

Data analysis is a systematic procedure through which the researcher moves from the collected qualitative data to an understanding of the participants' utterances in order to interpret and explain the phenomenon being investigated.

This procedure commences with the gathering of data and continues until the data has been evaluated. Consequently, data collection and analysis are interwoven and influence one another. This is asserted by Schurink, Fouche and De Vos in De Vos *et al.*, (2011:405) who state that data analysis is not a linear procedure but a cyclic process consisting of two procedures which go hand in hand in order to build a coherent interpretation of data. The data analysis process starts in the researcher's mind as data is being collected in the field and culminates in focusing on the pragmatics which involve sorting and handling the qualitative data. When undertaking the process of qualitative data analysis, the researcher can use one of the three approaches which involve inductive reasoning. The first approach involves coding the categories derived from the raw information. The second approach is directed content analysis in which coding starts with the theory or the relevant research findings and the researcher subsequently allows themes to emerge from the data. The last approach is summative content analysis which includes counting words as its starting point and continues to include latent meanings and themes (Hashemnezhad, 2015:60; Hsieh and Shannon, 2005:1283).

In the current study, the researcher used the general inductive and deductive processes of data analysis which involve the subjective interpretation of data through coding and theme identification. The preliminary phase of data analysis was done by transcribing verbatim the recorded interviews with the help of a colleague to ensure that everything said by the participant teachers and principals was accurately captured. The transcripts were returned to the participants to verify the accuracy of the contents and ensure the captured version was what the participant wanted to say. This verification process also served the purpose of member-checking to ensure credibility and trustworthiness and to clarify concerns that surfaced during the transcription and preliminary phase. As postulated by Hashemnezhad (2015:60) and Nieuwenhuis (2007:100), data analysis is guided by rigour, and the researcher in this study engaged in multiple readings of the transcribed data and constant comparison of data in order to gain an in-depth understanding of the various teachers' and principals' perspectives, and to be able to commence the inductive coding and thematic analysis.

In the coding process, the researcher identified texts that constituted meaningful segments to be used as units of analysis (See Appendix I). The researcher also realised that several text segments were coded in more than one category and these were indicated by the use of a different colour within a particular code. From the codes the researcher was able to identify the emerging themes and label them according to the research aims of this study. Subsequently the researcher grouped together similar interview questions and responses which conveyed similar opinions in order to facilitate the organisation of data. The researcher synthesised the responses and interpreted the participants' perspectives of ICT usage in teaching and learning. The next section presents biographical information on the participants.

5.3   PROFILES OF THE TEACHER PARTICIPANTS

The sample for this research study consisted of fifteen participants: they included five primary school teachers, five high school teachers, and three primary school principals and two high school principals. In terms of gender, three of the primary school teachers were male and two female, while there were four male teachers and one female teacher from the high schools. Two primary school principals were female and one was male whereas both high school principals were male. All the teachers have computer laboratories at their schools and recently their schools have been given tablets for ICT integration in the teaching and learning of English and Mathematics. Teachers have received varying degrees of training on the use of computers and other ICT tools available, but many teachers and principals are still uncertain about using tablets in executing their educational duties since the training received pertained to the basic operation of tablets and was not based on integrating the tool into teaching methods and learning styles. The teacher participants in the study were referred to as Teacher #1- #10 and their identity was known only by the researcher. The profile of every teacher participant drawn from the interview information is illustrated in the subsequent paragraphs.

5.3.1   Teacher #1

Teacher #1 is female, teaches at a primary school and has 20 years teaching experience. She has a Master's degree in Computer-Based Education. She teaches Natural Science in Grades 5, 6 and 7. Her school computer laboratory has 25 computers but she said the laboratory is always locked as the school management team and the teacher in charge of the laboratory do not understand the significance of computers in teaching and learning. However, the teacher explained that she uses her personal laptop and sometimes asks parents to allow their children to use their smart phones for educational purposes. It emerged from the interview that Teacher#1 has received relevant training with regard to technology knowledge, pedagogic knowledge and content knowledge and she is integrating these knowledge aspects into her teaching activities. This teacher indicated that she uses ICTs for research purposes as well. Training was provided by the University of Pretoria, GoL and SchoolNet. When asked about her experiences on how ICTs are used in teaching and learning at her school, Teacher #1 responded that their school computer laboratory was not functional and they had no access to the facility since the use of computers was not supported by the school leadership for teaching and learning. She stated that this was a waste of money and resources, and today's children need technology to learn more and to interact with other learners around the world.

5.3.2   Teacher #2

The participant designated as Teacher #2 is a male teacher at a primary school with 17 years teaching experience. He has an Advanced Certificate in Education (ACE) management qualification. His school computer laboratory has 25 computers and there are seven laptops for the SMT (School Management Team). There is also a media centre for reading where there are reading programs that are used for spelling, teaching learners how to read and phonics and he indicated that the computer laboratory is used for Mathematics and Literacy. He teaches Natural Science and Life Orientation in Grades 6 and 7. Teacher #2 said he does not teach with computers but teaches learners about the computers and how to operate them. Despite teaching learners how to operate the computer, Teacher #2 indicated that he was not fully confident about using computers for teaching and learning.

For his personal development and for the educational benefit of his learners he said he used the internet to get current information from other countries.

5.3.3   Teacher #3

Teacher #3 is a male and teaches at a high school with 24 years teaching experience. He has a Bachelor of Technology (BTech) qualification. His school computer laboratory has 25 computers and a further 20 computers were donated by Telkom. He teaches Physical Science in Grades 10, 11 and 12 and uses ICTs in most of his teaching activities. In fact without ICT, he said he felt like "a person who is slightly disabled". Sixty per cent of his lessons are prepared using ICTs and he uses Excel and PowerPoint presentations. Teacher #3 was trained by Microsoft South Africa (MSSA) and St Alban's College on the integration of ICTs into teaching Physical Science. He went on to explain that he still relies on MSSA for new ICT developments and innovations. He also teaches Physical Science to learners from other schools in the township through video conferencing. Knowing the significance of ICTs in enhancing teaching and learning, he encourages and trains other teachers how to integrate ICTs in their daily activities. Learners are allowed to bring their laptops, smartphones, iPads and iPods to class for educational purposes. Teacher #3 uses social media to interact with colleagues and always accesses websites for required information on issues such as CAPS.

5.3.4   Teacher #4

Teacher #4 is a male teacher at a primary school with six years teaching experience. He has a Primary Teachers' Diploma and teaches Computer Science, Natural Sciences and Social Sciences in Grades 5, 6 and 7. The school has a computer laboratory with 25 computers and internet connectivity, as well as laptops and tablets. Learners use the internet to search for information. Teacher #4 indicated that he had received training on ICT usage in teaching and learning in 2009 but the training was of short duration.

He indicated that he was very confident about operating computers and became proficient through self-study. Many teachers at his school do not use computers because they have

not been trained. He said that another factor contributing to lack of computer use was that teachers were unwilling to use computers in class is because learners know more about ICTs than they do, and did not want to look stupid in class. They sent their learners to the computer laboratory to do research but did not accompany them.

5.3.5 Teacher #5

Teacher #5 is a male teacher at a high school and has two years teaching experience. He has an Honours degree in Education (BEd Honours) and is teaching Mathematical Literacy, Physical Science, Natural Sciences and Social Sciences in Grades 8, 9, 10 and 11. The school has a computer laboratory with 25 computers and internet connectivity as well as laptops and tablets. Teacher #5 said he was very confident about using ICTs for teaching and learning although he had not received any training therein. He uses MS Word and Excel to prepare and present lessons, and he uses the internet to do research, get study guides and to connect with other professionals in the same field of study. Teacher #5 was concerned about insufficient ICT tools available and indicated that equipment such as printers, projectors, emails were needed in order to facilitate teaching and learning as expected. Training was another issue and should be more thorough to ensure that teachers acquired the necessary ICT skills.

5.3.6 Teacher #6

Teacher #6 is a male teacher at a high school with 13 years teaching experience. He has a Bachelor of Education degree and teaches Life Sciences in Grades 10 and 12. The school has a computer laboratory with 25 computers with internet connectivity, a laptop and a white board. The Plasma TV was stolen. The school also has 40 tablets. Teacher #6 received training for a week and says he has the skills to operate computers with any gadget available at school. He stated that the school has a Work Space software program from which they can download the information on the subjects taught at their school.

ICTs are integrated into Life Sciences, Mathematics and Technology. DVDs are used for learning channels where learners can do revision. Teacher #6 uses email to communicate

with other teachers. The participant reiterated that the lack of computers and ICT skills and the negative attitude of some teachers were major obstacles that hindered the use of ICTs to improve teaching and learning.

5.3.7   Teacher #7

Teacher #7 is a male teacher at a primary school with 13 years teaching experience. He has a Primary Teachers' Diploma and teaches Life Skills. The school has a computer laboratory with 25 computers and internet connectivity, laptops, tablets, radio and TV. Teacher #7 said the training provided by DBE was insufficient as it had lasted for about 15 minutes and was based on what had been installed in the labs rather the integration of ICT in teaching and learning. The internet is used by learners to get information. Teacher #7 expressed concern about the termination of the GoL internet service provider since he and the learners had been using GoL computers to clarify functional issues he was unsure of.

5.3.8   Teacher #8

Teacher #8 is a female teacher at a high school with 12 years teaching experience. She has a BEd qualification and teaches Technology and Science in Grades 8 and 9 and English in Grade 10. The school has a computer laboratory with 25 computers and internet connectivity, however, the computer laboratory is not functional. GDE also delivered 40 tablets for teaching and learning Mathematics and English. Teacher #8 was pessimistic about the tablets rolled out to replace GoL. She expressed concern about the SMT (School Management Team) for never using the laptops given to them or the computer laboratory. In contrast Teacher #8 uses her personal laptop and DVDs to improve teaching and to increase learners' understanding and performance. Teacher #8 indicated that using ICTs made her work easier and she was able to consult the DBE website to get clarification and updates on some issues pertaining to CAPS.

5.3.9   Teacher #9

Teacher #9 is a female teacher in a primary school with 15 years teaching experience. She has a Senior Teachers' Diploma and an Advanced Certificate in Education. She teaches social sciences to Grades 4, 5, 6 and 7, Life Orientation, Economic and Management Sciences and Natural Sciences to Grade 7. The school has a computer laboratory with 25 computers and internet connectivity as well as laptops and tablets. Teacher #9 responded that she is able to use a computer but did not receive any training. She is using the knowledge that she has acquired on her own. She is not confident as she does not have the required ICT skills and suggested that she needed training in order to integrate ICTs into teaching practice to enhance teaching and learning. Learners use computers for writing although they are not allowed to make printouts.

5.3.10   Teacher #10

Teacher #10 is a male teacher at a high school with one year teaching experience. He has a Bachelor of Education (BEd), Further Education and Training (FET) and Information and Communication Technology (ICT) Certificate in Education. He teaches Life Science and English in Grades 9 and 11. The school has two computer laboratories with 45 computers and internet connectivity, laptops and 40 tablets. Teacher #10 studied an ICT module which was compulsory during his pre-service training at university. He mentioned that he is very confident and computer literate and has the necessary ICT skills required for teaching and learning with and through ICTs. He also stated that he often uses ICTs in his Grade 10 to Grade 12 science teaching.

The teacher participants' information and profiles are summarised in tabular form illustrated below.

Table 5.1: Teachers' biographical information

Teacher participant	Gender and qualification	Age	Work profile
Teacher #1	• Gender: Female • Primary school teacher • Qualifications: Primary Teacher's diploma in ICT She is currently registered for Masters of Education (MEd) degree in Computer-Based Education	• 52 years	• Experience: 20 years • Subjects: Natural Science • Grades: 6 and 7
Teacher #2	• Gender: Male • Primary school teacher • Qualifications: Primary Teacher's diploma, ACE from UP	• 46 years	• Experience: 17 years • Subjects: Natural Science • Grades 6 and 7 • Life Orientation • Grades 6 and 7
Teacher #3	• Gender: Male • High school teacher • Qualifications: Teacher's diploma with B. Tech as the highest qualification	• 53 years	• Experience: 24 years • Subjects: Physical Science • Grades 10, 11 and 12
Teacher #4	• Gender: Male • Primary school teacher • Qualifications: Primary Teacher's diploma	• 45 years	• Experience: 6 years • Subjects: Computer Studies, Natural Sciences and Social Sciences • Grades 5, 6 and 7

Teacher #5	• Gender: Male • High school teacher • Qualifications: BEd (Hons)	• 34 years	• Experience: 2 years • Subjects: Maths Literacy • Grade 8 • Physical Science and Natural Sciences • Grades 9, 10 and 11
Teacher #6	• Gender: Male • High school teacher • Qualifications: Degree in teaching	• 48 years	• Experience: 13 years • Subjects: Life Sciences, • Grades 10 and 12
Teacher #7	• Gender: Male • Primary school teacher • Qualifications: Primary Teacher's diploma	• 49 years	• Experience: 16 years • Subjects: Maths, English and Social Sciences and Life Skills • Grades 5, 6 and 7
Teacher #8	• Gender: Female • High school teacher • Qualifications: BA in Education	• 40 years	• Experience: 12 years • Subjects: Science • Grade 12, • English • Grade 8, 9 and 10 • Technology and Physical Science
Teacher #9	• Gender: Female • Senior Teachers' diploma and Advanced Certificate in Education. Qualifications: BEd FET and ICT certificate in Education	• 44 years	• Experience: 15 years • Subjects: Social Sciences • Grades 4, 5, 6 and 7 • Life Orientation • Grade 7

	• Computer literacy certificate acquired before being employed by GDE		• Economic and Management Sciences • Grade 7 • Natural Science • Grade 7
Teacher #10	• Gender: Male • High school teacher • Qualifications: BEd FET and ICT certificate in Education	• 27 years	• Experience: 1 year • Subjects: Life Science and English • Grades 9 and 11

From the information given, it is clear that the participant teachers are well qualified in terms of their pedagogic professions and most have many years of teaching experience. Only two teachers are new to the teaching field. With seven of the participants being male and only three female, the biographical data highlights the gender gap and the disparity of ICT skills between male teachers and female teachers. At one high school studied, the only female teacher using ICTs in her lessons was significantly younger than her female colleagues. She said many of them were due to retire soon, so they did not see the need to learn about and use ICTs in their classroom.

It was the researcher's impression that few female teachers integrated ICTs in their teaching and one principal interviewed said women made excuses when asked to go for computer training and if they did, left the course early. In comparison, their male counterparts were keen to be trained on various computer programmes. The reason for this appears to be that male teachers are more confident when it comes to using technology and openly say technology is regarded as part of a man's world. Most of their female counterparts endorse this patriarchal mentality, lack confidence and have a negative attitude toward integrating ICTs into their teaching practices. This is confirmed by Du Toit (2015:17) in stating that the level of ICT usage by female teachers is low due to lack

of ICT skills. Du Toit (2015:17) further states that many female teachers do not engage in using technology for teaching despite having access to various ICTs at school.

Contrary to Du Toit's assertion, Aslan and Zhu (2016:367) found that gender was not an issue in motivating teachers' use of ICT in teaching and learning. Teachers are integrating technology in their practices regardless of their gender. It can be deduced that the pre-service teacher training programmes are well designed to equip student teachers with ICT skills to facilitate teaching and learning process effectively. This being the case, it is necessary for the training ICT programmes to be based in the context of in-service South African teachers so that they can acquire the ICT skills suitable for the adaptation level in which a teacher is able to integrate ICT into teaching and learning.

The schools which have been identified for this study have basic ICT infrastructure for use by all teachers. Secondly, teachers use the internet to submit reports and schedules for administration purposes. The information above reveals that the high school teachers use ICTs more than primary school teachers. Age plays an important role as far as the adoption and use of ICTs by teachers. From the biographical data and through observation it became evident that younger teachers who have encountered and used computers in their tertiary education and their teacher training do not encounter problems when it comes to integrating ICTs into their teaching unlike older teachers who tend to cling to traditional chalk and talk methods of teaching. The generation gap appeared to have an influence on teachers' beliefs in terms of ICT usage in teaching and learning. The school principals have the task of encouraging all teachers to use ICT despite the beliefs. The profiles of the principals who participated in this study are discussed in the next section.

5.4   PROFILES OF THE PRINCIPAL PARTICIPANTS

The principals who participated in the study consisted of two female principals, heading primary schools, and three male principals. Of the three male principals, two are high school headmasters and one is a primary school headmaster. Their schools have ICT infrastructure and internet connectivity, and educational software is embedded in the

computers and the tablets but they do not have educational programs that belong to their schools.

The principals were from various schools and were referred to as Principal #1 up to Principal #5 and their identity is known only by the researcher. Four of the five principals and four of the ten teachers who were interviewed came from the same schools and the schools are: School B, School D, School F and School J are the ones in which the principals were interviewed with their teachers. In the remaining schools only the principal or the teacher were interviewed. The selected eleven schools designated as School A up to School K and participants are summarised in the table below:

Table 5.2: Sampled schools and the research participants

Sampled schools	Principal participants	Teacher participants	Number of participants
School A: Primary School	None	Teacher #1	1
School B: Primary School	Principal #4	Teacher #2	2
School C: High School	None	Teacher #3	1
School D: Primary School	Principal #2	Teacher #4	2
School E: High School	None	Teacher #5	1
School F: High School	Principal #1	Teacher #6	2
School G: Primary School	None	Teacher #7	1
School H: High School	None	Teacher #8	1
School I: Primary School	Principal #5	None	1
School J: Primary school	None	Teacher #9	1
School K: High School	Principal #3	Teacher # 10	2
Totals	**5**	**10**	**15**

Some information was clarified and added during the follow-up session in which the participants were given the transcripts to ascertain if what was captured was an accurate reflection of what they had said.

5.4.1   Principal #1

Principal #1 is male and a high school principal with five years' experience. The school has a computer laboratory with 25 computers, laptops, smartphones and 40 tablets. Principal #1 indicated that he endorses the use of ICTs in teaching and learning. He mentioned that ICT is the way to go and DBE emphasises the use of technology in teaching and learning. The desire and the obligation to use ICTs to improve teaching and learning were supported by the following response:

> **"***Using a computer is better because learners can see pictures and listen to the audio at the same time. It is visual"*. (Principal #1, See Appendix K)

Principal #1 mentioned that there is enthusiasm among both teachers and learners, and ICTs are used on a daily basis as pedagogical tools. The principal's enthusiasm is expressed in his response quoted as:

> *"Yes they [teachers] use ICT for instance in our staff room, teachers can now prepare their lessons, they can access various topics on the computer and internet. Yes, it is, I mean as these teachers are busy doing that"*. (Principal #1)

He further said that the use of Mathematics computer programs is most welcome because learners cannot add or subtract. This has been established by the poor performance in Mathematics by South African learners when compared with learners from other countries. Although Principal #1 spoke positively about the need to use ICTs in teaching and learning, he said the school did not have a school-based ICT policy.

The principal's enthusiasm regarding ICT use in his school and the observation data elucidated how certain teachers and learners utilise the two computer laboratories to their benefit. Therefore, this attitude encourages those learners who are not using those available ICTs to do so. Learners who do not make the most of the opportunity may see themselves as marginalised due to the fact that they are not part of ICT innovation. The

interaction of learners with ICT under the guidance of the teachers is evidenced by the interview response which highlights the benefits of ICTs in teaching and learning.

> *"Yes, there is a space where they are able to participate like for instance in using whiteboards. This is where we use the ICT in terms of, they must revise on their own, they must be able to understand or we can put, DVDs that is learning channels, where they can be able to revise using it".* (Teacher #6)

5.4.2   Principal #2

Principal #2 is a female principal of a primary school with three years of experience. The school has a computer laboratory with 25 computers, 38 tablets for learners and 2 tablets for teachers. There is one teacher who teaches Computer Literacy to learners in Grades 4 to 7. The computers are used in teaching Life Skills and Natural Sciences and the internet is used to search for information. She was concerned about the backlog because some computers had been stolen. Another challenge was the lack of a security system as indicated in this response:

> *"No alarm system and computers get stolen."* (Principal #2)

Poor security and the evidence of the burglary as observed indicate a gap in the policy regarding the safe guarding of the ICTs. This indicates to the researcher that policy is not being adhered to and the financial implications could be the reason that bars the GDE from providing the security required to protect school ICT laboratories. Therefore, the school community and the larger community should develop a sense of ownership of the school and make it the responsibility of the whole community to look after the school property.

Principal # 2 further indicated that 25 computers and 38 tablets were not enough to engage all learners with ICTs in the classroom or in the computer laboratory. The statement confirmed research findings of many researchers as indicated in Section 3.7 that ICTs in many schools were inadequate. The school does not have a school level ICT policy.

5.4.3   Principal #3

Principal #3 is a male principal of a high school with two years of experience as principal. He has a B.Ed. qualification. The school has two computer laboratories, one with 25 computers and internet connectivity while the other laboratory has 20 computers donated by the private sector. Other ICT tools included laptops, a TV, overhead and data projectors and speakers. GDE has delivered 40 tablets with internet connectivity: 20 for the teaching of English and 20 for Mathematics teaching. Internet was provided by the GoL service provider. Principal #3 mentioned that he encouraged his teachers to prepare their lessons using available ICTs and also made sure that there was at least one ICT period per week for every grade. The school policy encourages the use of ICTs but the school does not have a separate ICT policy.

The researcher's observation of two computer laboratories and 40 tablets indicated that the school had enough ICT tools to engage all teachers and learners in using ICTs for teaching and learning although the principal was dissatisfied with the ICT infrastructure in his school. That was expressed in the response:

> *"We have two computer laboratories, one established by the Department and the other by the private company. We also have received 40 tablets. Yes we do have facilities but they are not adequate enough to cover everybody".* (Principal #3)

The researcher of this study is of the opinion that a well-crafted timetable will allow every learner and every teacher to use ICTs for teaching and learning in one way or another. The principal's advice to teachers to have one period a week and not have a timetable to give teachers a direction amounts to not doing enough to encourage ICT use in the school. Lack of the inclusion of ICT in the school timetable implies that the principal as an instructional leader is ignoring some of his responsibilities as shown by Nkula and Krauss (2014) and Lunenburg (2010) in section 3.5 of Chapter 3.

5.4.4 Principal #4

Principal #4 is a female principal of a primary school with two years of experience as principal. ICTs at her school are used in teaching Natural Sciences and Life Skills. The school has a computer and a media laboratory. The school is situated in an informal settlement and serves the poorest of the poor with many learners who are foreigners from Mozambique and Zimbabwe. Principal #4 acknowledged the national and the provincial ICT policy initiatives but said many teachers are not ICT literate. There are 42 staff members with a few teachers who are partly ICT skilled. The school did not have an ICT policy document. The principal said that ICT should be included into the curriculum and be catered for in the school timetable. This indicates to the researcher that the policy is not adhered to; financial implications could be the reason that bars the GDE from providing the security required to protect ICT in the school ICT laboratories. Therefore, the school community and the larger community should develop a sense of ownership of the school and make it the responsibility of the whole community to look after the school property.

The principal indicated that some learners in her school especially in Grade 7, have cell phones which are used for communication, to check spelling and to search for information and reiterated that learners under general do like computers and cell phones:

> "*Learners enjoy working with cell phones and computers*". (Principal #4)

This response confirmed Mayisela's findings (2013:17) that many learners in Gauteng Province use cell phones and other ICTs for communication and for learning purposes. Therefore it can be mentioned that desire to have ICT included in the school timetable is aimed at encouraging teachers to integrate ICT and be facilitators to assist and scaffold learners to achieve better as indicated by Vygotsky (1978) in Chapter 2 and Shin *et al.*(2012:452) in Chapter 3 of this study.

5.4.5   Principal #5

Principal #5 is male and headmaster of a primary school with sixteen years of experience as a principal. ICTs at his school are used in teaching Natural Science, English and Life Skills. The school has a partnership with Umfeld Junior Primary School in Britain from which the principal has had first-hand information and experience on how teachers use ICTs across the curriculum. He mentioned that every learner has a laptop/ computer. That made teaching easy at the school. He encouraged his teachers to enrol for ICT courses in order to acquire the necessary skills. The researcher's observation data of a well-equipped computer laboratory which was used mostly by the administrative personnel confirmed that ICTs were not used for the intended reason. Therefore, the researcher concluded that teachers felt inadequate and thus distanced themselves from ICTs for teaching and learning. The interview data alluded to teachers' poor ICT skills and a small percentage of teachers who are only slightly ICT literate. The school principal at the participating school pinpointed lack of ICT skills and a low number of teachers who were using ICTs for their own work:

> "*20% of my teachers are computer literate, that is why we are encouraging teachers to enrol for technology courses in order to gain knowledge*". (Principal #5)

The researcher of this study recognised the principal's admission of lack of ICT skills and considered that as a major hindrance to ICT use in school. Lack of ICT skills among South African teachers was emphasised by researchers such as Msila (2015) and Chigona *et al.*, (2014) and this factor should be given the utmost attention so that all learners could be encouraged to engage in constructivist approaches as indicated by Shin *et al.*, in Chapter 2.

Although the school is in an informal settlement, it has resources such as a computer laboratory with 25 computers, 40 tablets and a media centre which are the basic requirements to initiate teaching and learning with ICTs, but these resources are inadequate given the number of learners. Principal #5 indicated that they had an ICT school policy but it was not produced when the researcher requested it. The profile details of the principal participants are illustrated in the table below:

Table 5.3: Principals' Biographical Information

Principal participant	Gender and qualification	Age	Number of years of experience
Principal #1	• Gender: Male • School Type: High school • Qualifications: BEd Honours Education Management and Policy	58 years	5 years
Principal #2	• Gender: Female • School Type: Primary school Teacher's diploma	51 years	3 years
Principal #3	• Gender: Male • School Type: High school Qualifications: Senior Education Diploma.	57 years	2 years
Principal #4	• Gender: Female • School Type: Primary school Qualifications: BA degree and Primary Teacher's diploma	56 years	2 years
Principal #5	• Gender: Male • School Type: Primary school Senior Education Diploma	58 years	16 years

The principals' qualifications indicate they are academically qualified for their current positions as instructional leaders. The years of experience as school principals vary from two to 16 years. Four of the principals are over 55 years of age which indicate that they are about to exit the system which could have a negative impact, resulting in them losing interest in introducing innovations such as ICT integration at their schools. The youngest principal, a female, is at the beginning of her career as a school principal. The analysis of the

interview data of all teacher and principal participants in the form of themes and categories is presented in the next section.

5.5 PRESENTATION OF EMPIRICAL FINDINGS

The aim of this study was to investigate teachers' experience on ICT usage in teaching and learning in urban schools. The analysis of the interview data was based on the utterances of the teacher and principal participants. This study indicates that teachers' use of ICTs for teaching and learning is characterised by factors that emerged as themes during the coding and the theme analysis process. These themes were synthesised and four important themes that emerged in terms of the researcher's judgement are indicated as follows:

- Inadequate ICT infrastructure
- Proficiency in ICT usage
- Training
- ICT benefits and challenges

The categories are discussed under the heading of the relevant theme in the subsequent discussions.

5.5.1 Themes emerging from teachers' empirical research

The themes which emerged from teachers' deliberations and responses were inadequate use of ICTs infrastructure, teachers' proficiency in ICT usage, ICT benefits in teaching and learning and challenges related to ICT usage. The themes and the categories are discussed in the subsequent paragraphs.

5.5.1.1   Theme 1: Inadequate use of ICTs infrastructure

This theme, inadequate use of ICTs, centred on the availability of the ICT infrastructure, the human resources and other necessary attributes which are prerequisites for the facilitation of teaching and learning with ICTs. The theme was flagged in the following categories.

Category 1.1: Insufficient computers

The first theme pertains to ICT infrastructure in schools. Teachers generally seemed impressed by having basic ICT infrastructure which comprises computers, tablets, educational software provided by GoL and software that is embedded in the tablets, a projector, a television set in some schools and internet access. Despite their availability, the 25 computers and the 40 tablets rolled out to each school in Gauteng Province are said to be not enough for use by all staff members and to cater for all the learners in a class. Insufficient numbers of computers and tablets were a demotivating factor which resulted in teachers feeling helpless and disillusioned in terms of using ICTs for teaching and learning since it was impossible to engage all learners effectively especially since learners could not work alone at their pace and according to their potential. As teacher participants explained:

> *"We have twenty five computers for the learners".* (Teacher #4)

> *"According to the number of learners that we are having, 25 computers are not many or enough for all the learners. I mean that there should be three more computer classes".* (Teacher #8, see appendix J)

Emphasising ICT inadequacy in schools as a major hindrance when integrating technology into teaching and learning, one of the participants stated:

> *"We need facilities for the learners; printers, projectors, emails for learners".* (Teacher #5)

For the researcher these comments demonstrate the desire and passion of teachers, especially the younger ones, to have the ICT equipment to enable efficient teaching strategies which will benefit all learners and assure the attainment of educational objectives. These ICT tools provide learners with opportunities to engage in more effective, collaborative and individualised learning which is characteristic of teaching and learning in the 21 century.

Category 1.2: Lack of educational software

In addition to computer inadequacy, teachers expressed concerns about the lack of software which implies that the presence of computers without educational software is of no use. It is important that each school has its own educational software to ensure successful use of ICTs by teachers and learners. Dependency on educational software embedded in the computers and tablets cannot be relied on due to the fact that service providers can terminate their services and other mishaps such as theft are issues that schools battle with.

Two teachers said they had the software for their subjects but indicated that the software was their personal possession. The teachers responded in the following manner:

> *"I show them* [learners] *most of the things on my laptop"*. (Teacher #1)
> *"Not at school but in my own laptop* [software]*"*. (Teacher #8)

The above comments indicate that these teachers are using their own money to secure the educational software relevant for their subjects. Since teachers are using their own money to buy the necessary software, it is clear that the software is their personal property and the chances of sharing it with other staff members are unlikely.

ICT integration in teaching and learning occurs more in high schools than in the primary schools as shown by the subjects in which ICTs are used. However, teachers expressed dissatisfaction saying:

"We have some [software] *but not adequate enough".* (Teacher #10)

Other teacher participants were specific and singled out: *"Life Sciences, English, Geography, Mathematics, Physical Science and Natural Science"* as the subjects that are taught with ICTs (Teacher #5, Teacher #8, Teacher #9 and Teacher #10).

The availability of software only for these subjects indicates that many subjects in the curriculum are left out. This has a number of consequences: firstly learners are deprived of the opportunity to learn with ICTs; learners are unable to enrich their learning by researching on the internet; they are unprepared for the computer literate environment they will encounter in the future and are unable to network with learners from other countries; and finally the lack of software may encourage teacher-centred approaches with teachers overlooking innovation and clinging to traditional teaching methods. It can also be concluded that there is little or no professional development for teachers who do not use technology for better teaching opportunities.

One of the participants indicated that the lack of software for African languages constituted a major problem since in the primary school, teaching and learning in home language was of critical importance for the ability to learn in the second language in later years. The teacher participant pinpointed the need to have:

> *"Xitsonga and Isizulu software to equip learners with reading and language skills since these languages are home languages of most of our learners."* (Teacher #2)

Despite the general outcry by many teachers, some high school teachers expressed satisfaction about the educational packages available at their schools for teaching and learning. One participant made the following comment about the application software packages:

"I've got software called Workspace, it has all learning areas. Maths, Science, Life sciences, whatever subject that you can mention, it has got everything". (Teacher #3)

In the researcher's opinion, primary schools are disadvantaged because many teachers are poorly informed about application software whereas high school teachers, by virtue of the inclusion of computer literacy in their teacher training courses, know exactly what packages can be used.

Category 1.3: Limited and unused space

A number of teachers indicated that their computer laboratories have 25 computers and are designed to accommodate 25 learners. However, one computer laboratory is not sufficient to cater for classes which have more than 25 learners and one computer laboratory is not sufficient for a school. The size of the computer laboratory is said to be unacceptable as illustrated by the following response:

"The computer lab is so small. I mean that there should be three more computer classes". (Teacher# 8)

The same concern was reiterated by another participant who mentioned *"not enough space"* (Teacher #10) as one of the challenges that prevent successful integration of ICTs for teaching and learning. Two of the high school teachers (Teacher #5 and Teacher #10) indicated that their schools have two computer laboratories provided by GDE and the private sector. The presence of two computer laboratories and 38 tablets for learners, when well managed through the timetable, meant ICTs could be accessed and used by teachers and learners in a way that benefits all.

Two teachers reported that their computer laboratories are not being used and are always locked:

"The person who is in charge of the computer laboratory centre lab doesn't have any knowledge about ICTs and he does not open the computer lab". (Teacher #1)

"I wish that lab was functional because I mean it is a waste of room, a waste of space, equipment. I wish somebody could come and inspect the computers and upgrade the software so that learners especially learners in grade *11 and 12 could have access to the internet"*. (Teacher #8)

Category 1.4: Power interruptions

Teachers also complained about the power cuts which were experienced in many areas in South Africa and which also affected schools by interrupting the use of computers and the internet. One of the teacher participants reported that:

"Another thing that makes some work difficult is that many times we do not have power. The computers and the internet depend on an uninterrupted supply of electricity otherwise we are being discouraged from using the computers and we resort to chalk and talk method. This is a serious challenge". (Teacher #8)

Due to these circumstances, it is clear to the researcher that there is a low level use of eLearning taking place in the selected schools and other public schools in Gauteng Province. The consequence, in the researcher's opinion, is that many enthusiastic teachers may lose interest in adopting and accepting ICTs as part of their pedagogic culture. The traditional methods of teaching and learning which are inappropriate and inadequate in the 21st century could be perpetuated by those teachers who are sceptical and negative about the use of ICTs in teaching and learning due to the factors indicated above.

5.5.1.2   Theme 2: Teachers' proficiency in ICT usage

Teachers' responses indicated a lack of TPACK, which is a major stumbling block and consequently results in low ICT proficiency, although they said they had the knowledge to operate a computer and navigate the internet to search for information. The categories that were used to develop this theme were training, ICT skills and confidence and were found to be overlapping in the various text segments. The categories are highlighted in the subsequent sub-paragraphs.

Category 2.1: Lack of ICT skills

Training and acquisition of skills cannot be separated as one is the prerequisite of the other. Many primary school teachers indicated that ICT skills are crucial for ICT integration in teaching and learning. They highlighted that their inability to use ICTs in teaching is due to the fact that they do not have adequate technological skills and the challenge is further compounded by not knowing how to integrate the technological, content and the pedagogical knowledge. One teacher participant conveyed his frustration by mentioning that:

> *"Some methods used inside the computer are very difficult because we*
> *were not trained by the government on how to use them".* (Teacher #7)

As a result of these situations, teachers are unable to usher in the desired transformation due to insufficient ICT knowledge. In spite of those shortcomings, participants showed determination to go ahead with ICT integration if they could be trained in TPACK as illustrated by Koehler and Mishra (2009). The willingness is shown by a teacher who indicated*:*

> *"I would like to be workshopped more so that I can be 100% confident.*
> *Then I will be able to integrate my teaching with ICT".* (Teacher #9)

Category 2.2: ICT training

Some teacher participants said that they did not receive training on ICT integration in teaching and learning which explains their inability to use ICT in their teaching and also indicated this as the reason why the available ICTs in schools are not fully utilised. The majority of the primary school teachers acknowledged that their inability to integrate ICTs in their pedagogic practices was a result of not being trained for this purpose and the educational authorities were blamed for this. Regarding the lack of training, one teacher participant responded as follows:

> *"It is a challenge… I have not yet been trained; I am only using the knowledge that I have. We need to be workshopped".* (Teacher #9)

Some teacher participants explained they had informal training but do have the necessary skills required for integrating ICT into teaching and learning. A participant explained as follows:

> *"I am very confident. I haven't received any formal training in ICT but I do know how to use ICT instruments through self- training".* (Teacher #5)

Teachers who acknowledged having received some training stated that their training was inadequate and concentrated on the operation of a computer rather than the pedagogical use of a computer needed to empower teachers with ICT skills for the enhancement of teaching and learning. This was evident in this utterance:

> *"We teach children to type, to save and other simple operational skills".* (Teacher #7)

This is an indication that some schools are only engaged in teaching learners technological skills and are overlooking teaching and learning with ICT which is of great importance in the 21st century for the development of a knowledge-based society. In many instances the

training was not enough to equip the teachers with the skills and competencies required for the efficient integration of ICTs for teaching and learning.

Different training durations were highlighted and varied from one hour, one day, five days, two years and on-going training. The primary school teachers were most affected by minimal training. One of the primary school teachers attested to this stating that:

> *"I got training but it is some time ago. I think it is 2009. The training was*
> *for one day for about an hour".* (Teacher #4)

The year in which the training happened clearly indicates that the acquired skills are outdated as new technologies are constantly being developed. Clearly the participant's skills have not been updated in seven years and given the rapidly developing digital world, one must assume that all his skills would be out of date unless he had consistently upskilled himself. Given his initial training was for an hour, it can be assumed training focused on the acquisition of technological not pedagogical knowledge. To use ICTs effectively teachers need TPACK which means technological, pedagogical and content knowledge. The fact that teacher #4 made a point of staying abreast of new technological developments would indicate his self-motivation and positive belief in ICTs for pedagogical purposes.

In terms of the duration of training, high school teachers are better off compared to primary school teachers because they have technological knowledge, content knowledge and pedagogical knowledge. Primary school teachers may not have the necessary technological knowledge required to teach.

> *"Computer literacy was one of my compulsory courses at varsity".*
> (Teacher #8 and Teacher #10)

By having studied Computer Literacy at university level, it can be assumed that these teachers have mastery of technological knowledge which is one of TPACK aspects and an enabler for teachers to implement technology for teaching and learning.

Teacher #10 is advanced with regard to using and integrating ICTs in teaching. His teacher training programme and the collaboration with other teachers and schools in terms of ICT integration in his subjects has contributed a great deal in equipping him with the required ICT skills and confidence. To indicate his commitment to integrating ICTs, he mentioned that:

> "I use ICT for lesson planning, I use the internet for research and to get more information regarding my subject and lastly I communicate with colleagues through the social media. As for my learners, I allow them to use cell phones for internet and to record what I am teaching them". (Teacher # 10)

From this teacher's information, it is clear that he relied on ICT to perform his pedagogical responsibilities and he used it frequently. It is evident that Teacher #10 has an acceptable level of ICT competence and can integrate his teaching methods with technology in the classroom. In an informal conversation, Teacher #10 indicated that he attends ICT workshops organised by institutions such as CSIR just to gain more knowledge.

Such teachers can help to transform schools by encouraging ICT usage among teachers who are disillusioned about ICT integration in teaching and learning. Teachers like Teacher #3 are crucial in imparting the skills needed to get the best out of using ICT in teaching and learning and to liaise with the school leadership in ensuring effective ICT use.

Teacher #6 who is also a high school teacher explained his thorough training in this manner:

> "I attended the course at Valhaal where they taught us how to draft anything that there is about a method of teaching and learning, for instance, how to draft a working mark sheet, anything that has something to do with learning". (Teacher # 6)

Category 2.3: Confidence

In terms of the ability and the confidence in ICT usage, high school teachers in this study are more confident in integrating ICTs into teaching and learning than their primary school counterparts. The high level of confidence in ICT usage in the learning situation is indicated by high school teachers and their statements are as follows:

> *"I use Word and Excel* (Microsoft) *to prepare and present in my teaching. I use the internet to research for some of my teaching".*
> *(*Teacher #5)

> *"I use ICT for lesson planning and allow learners to use cell phones for internet and to record what I am teaching them".* (Teacher #10)

Contrary to high school teachers, lack of ICT skills and poor confidence in primary school teachers was evidenced by the following response:

> *"I'm not confident, not that much capable, I'm not 100% confident".* (Teacher #2)

Poor or lack of training, lack of ICT skills and lack of confidence translate into low proficiency. These three factors inhibit teachers from using ICTs for teaching children who are very comfortable with technological tools. Exposing teachers to well thought-out and appropriate training is the first step that will lead all teachers to adopt and appropriate the use of ICTs for curriculum delivery. As stipulated in the national ICT in education policy (DBE 2004: 25), all teachers are expected to be computer literate, information literate and be able to integrate ICTs into their methodologies for delivering subject matter to their learners. In terms of the stages of ICT adoption and use, data indicate that the majority of the teachers are at the entry level, and a limited number of teachers who are applying ICTs are at the adaptation stage.

Category 2.4: Lack of interest and resistance

Lack of interest, negative attitudes and resistance surfaced as some of the factors that deter teachers from using ICTs. The refusal of some teachers to implement ICTs is a big concern for those teachers who are committed to using ICTs to improve teaching and learning and to comply with global education demands. Teachers exhibit these traits due to the fact that they do not want change and want to continue with their old methods. Teachers' lack of interest in ICTs for teaching and learning is evidenced by the following comment:

> *"Some* [teachers] *send learners to do research on the internet without accompanying them".* (Teacher #4)

Lack of interest is shown by the majority of high school teachers despite having ICT skilled colleagues who are ready to help them acquire ICT skills. ICT-literate teachers expressed their frustration with the lack of interest and unwillingness of some teachers to use ICT:

> *"We still have a problem with teachers who cannot use the equipment. That is the challenge we have".* (Teacher #4)

> *"We've got old teachers here, that even if you try to involve them in terms of using the ICT, they are not part and parcel of it, they are not willing actually".* (Teacher #8)

This negative attitude is exacerbated firstly, by the fact that a number of teachers are old and are nearing retirement as pointed out by young teachers who are use ICTs in their teaching activities. The second reason is that some people dislike change and are technophobic. The negative attitude and the reluctance to use ICTs by some teachers also indicate that the education authorities who are gate keepers and the school leadership are not executing their tasks as indicated in South African ICT in Education Policy (DBE, 2004). Some teachers commented as follows regarding the older teachers:

"Some were born before technology; some of them are about to exit to retire, so as a result they are not interested per se in being computer literate so most of them are computer illiterate". (Teacher #7)

"Some of my colleagues still believe that chalk and talk is the best way, they close their eyes, close their ears. If they are interested it will take them something like two to three weeks to get used to any software or hardware that is introduced into the system". (Teacher #3)

The persistence of such attitudes in the school environment discourages teachers who are eager to share and impart their skills so other teachers can integrate ICT into their lessons and enhance learning.

5.5.1.3   Theme 3: ICT benefits in teaching and learning

Teachers emphasised the relevance of using ICTs and acknowledged the benefits of ICTs to both teachers and the learners. ICT was seen as a catalyst for addressing educational ills thereby bringing the envisaged change required in the digital era. The utterances that expressed the affordances of ICTs in teaching and learning are illustrated in the following discussions.

Category 3.1: Content delivery and manner of use

ICTs were hailed by all teachers as a better method for delivering their subject matter. Teachers who use ICTs on a daily basis recommend them for effective and individualised learning and mentioned that ICTs actively enable learners to learn by doing. This is in line with the quotations from two teacher participants which are stated as follows:

"Learners are visual and practical. They see theory in practice as ICTs use simulations and authentic material to improve learners' understanding. Learners are stimulated they participate and are actively involved in the teaching and learning process". (Teacher #3)

"Learners are visual and more practical and are accommodated by ICT programs". (Teacher #10)

Consistent with the above comments, another teacher commended ICT for teaching and learning and stated that:

"Learners grasp knowledge visually, and if they see something it becomes easier for them to understand". (Teacher #8, see Appendix J)

The power of pictorial images in the long term memory was portrayed in this manner:

"Learners do not forget the pictures they had seen on a computer".
(Teacher #1)

The use of the internet by teachers is seen as an advantage in that it enables them to get current information which can be used to enrich their learners. In commending the use of the internet, many teachers explained how the internet benefits them:

"I use the internet to keep up with the latest updates and improvements, new knowledge in a number of sites". (Teacher #10)

"I get a lot of things from the internet because some of the information we are having may be old and coming from the old syllabus but you can get recent information from the internet". (Teacher #6)

"*I use internet for research, learning material and to get a better understanding on unclear matters".* (Teacher #5)

From these comments, it can be understood that the use of ICTs and the internet improve learners' interest, understanding and the concentration and results in the enhancement of teaching and learning.

These assertions are consistent with goals for the introduction of ICT and eEducation in all South African schools and the Gauteng schools in particular (White Paper, 2004:6 and 16-17; GED, 2007:4). All teachers indicated that ICTs do change the way they teach and reported positive learning effects in learners. They expressed the need to embrace and use ICT across the curriculum in all schools to guarantee a future ICT knowledgeable and capable workforce which is an integral part of the network and knowledge-based society and on which the economy of the country will depend on for growth.

Category 3.2: Teaching style

The introduction of ICTs in teaching and learning is an innovation which does not replace the teacher but it affords teachers a new role as a facilitator and provides various options to enable the teacher to achieve educational goals irrespective of learners' potential. A teacher participant supports this assertion, stating that:

> *"I assume a role of a facilitator rather than an authoritative figure".*
> (Teacher #10)

The new role of the teacher was ushered in by the 21st century learner who regards technology as part of their culture and prefers to be taught on their terms. One teacher acknowledged that 21st century learners learn in a different way and their demands are different from boomer learners. As a result today's teachers are compelled to adopt new ways of teaching:

> *"The learners we have today are not the reading generation, this changes teachers' teaching methodology as teachers have to adapt to cater the digital learner".* (Teacher #2)

The same motivation for adopting new methods of teaching due to the fact that the digital generation has its own peculiar way of doing things and the ubiquitous nature of ICTs in the teaching and learning situation is expressed as follows:

"Teachers must change as they are teaching digital kids. They need to grow and use other ways and methods of teaching so that the kids do not become bored". (Teacher #1)

The confirmation of a new educational dispensation with the digital generation is indicative of the teacher no longer being the only source of knowledge but *"learners on their own through the internet can download information and come to class to compare and share knowledge."* (Teacher #3)

Category 3.3: Learning styles

Learners differ in terms of potential and their learning styles. Those with well-developed cognition understand the subject matter with ease whilst there are those learners who take time to understand and need visual material to facilitate mastery of the subject matter.

ICT and digital content have a motivational impact on learners and can support them in terms of visual, auditory, kinaesthetic, social , solitary, linguistic (reading and writing), and logical approaches to learning styles (Muniandy and Shuib, 2016:5). The visual and simulation software offer practical approaches on how experiments should be performed, how to use feedback, second language learners can listen to how words are pronounced while kinaesthetic learners learn by doing. These approaches demonstrate how flexible ICTs are in accommodating learners with various learning styles to achieve learning outcomes. The positive effect of ICTs on various learning styles was referred to as follows:

"Learners are visual and practical, they see theory in practice". (Teacher #10)

"In a Social Sciences lesson, learners can see images and they do not forget what they have seen". (Teacher #4)

Learning by doing is one of the characteristics of the digital generation and at the same time it emphasises the role of a teacher as a guide and a facilitator. Teacher #9 said ICTs enabled her learners to learn by doing and in this way they became involved.

> *"In using computers you have full attention and they are more interested because they are using their hands".* (Teacher #9)

Teacher #3 mentioned that in his use of ICTs, he finds learners differ according to their learning potential and he caters for all learners in class to ensure everyone has mastered the material and that he has attained his educational outcomes. He stated:

> *"In integrating ICTs, I make a break down and accommodate learners who are smart and those who are struggling. I allow learners to record me while I am teaching and they are able to get a repeat from the recording of their cell phones".* (Teacher #3)

In order to ensure that even struggling learners master the subject matter, one teacher participant mentioned that devoting more time helps learners to take control of their learning and eventually develop the understanding required. The teacher explained he helps learners with learning challenges in the following way:

> *"I create a space for them* [slow learners] *after school where I will give more attention to them."* (Teacher #5)

In spite of having learners with different styles, many teachers viewed ICTs as enablers to increase learners' motivation, boost self-confidence and self-esteem and the act of learning is regarded as fun as they interact with technology at their own pace. Both primary and high school teachers indicated that many children are fascinated by ICTs and some stated that:

> *"Interacting with computers becomes fun while they* [learners] *are learning at the same time."* (Teacher #2)

"The use of cell phones and iPads makes it easier for learners to engage in learning and learning activity is seen as fun." (Teacher #5)

In addition to the above mentioned benefits of ICT, the capability of ICT was extended to other aspects:

"ICT enhances their [learners] concentration. If you bring something that's technologically related, we've got their attention, they will concentrate, they get excited and never forget what they have seen rather than you [teacher] standing in front of them reading written text." (Teacher #8)

Individual active learning and cooperative learning are conducted efficiently with the use of ICTs. Teachers explained with the limited number of computers, learners are grouped to work together but their cognition processes determine the individualistic learning of each learner. The individual and cooperative learning are learning processes used interchangeably by some of the teachers.

The following comment confirmed the use of both learning processes as determined by the various learning theories of behaviourism and constructivism as discussed in subsection 2.5.

*"Learners were given a research project. They had an opportunity of doing the search and then downloaded the information and did the comparison in class." (*Teacher #3*)*

Teacher #2 and Teacher #3 indicated that ICTs facilitated the cooperative learning process and accommodated learners with different potentials, created an opportunity for peer tutoring and actively engaged every learner:

"Learners work in groups and they help each other." (Teacher #2)

"Learners in my class are in groups of six consisting of gifted learners, average learners and those who struggle. In their groups they work

together and are able to help one another. They even use the cellphones

to ask and to exchange information on the projects and assignments."

(Teacher #3)

Category 3.4: Communication using ICTs

High school teachers acknowledged the importance of ICTs for their professional development and for communication with other teachers with the same interests. This is evidenced by one teacher participant who stated:

"Currently I am on Twitter and there is a group of educators who are

following three departments: Science and Technology for any new

developments that are coming through; the Department of

Communication with career information for learners and the

information that I am utilising; and the Department of Basic Education

to get updates of information and specifically CAPS." (Teacher #3)

Teacher #3 indicated the importance of e-mails when learners wanted to communicate with teachers, stating:

"When you have given them [learners] *an assignment, you find some of*

them sending emails saying: "Sir, how do I go about … Then that is

when I noticed the importance of email."

In terms of discussing and helping each other with regards to the subject they are teaching, Teacher #6 stated: *"We communicate with e-mails."*

5.5.1.4   Theme 4: Challenges related to ICT usage

Teachers showed that they were enthusiastic and willing to use ICTs based on the affordances they had cited; however, they identified a number of factors which negatively affect the use of ICTs in teaching and learning at their schools. These factors result in

negative attitudes in teachers towards the use and the implementation of ICTs in teaching and learning. Digitally-savvy learners, lack of time and non-inclusion of ICT in the school's timetable, lack of ICT follow-up workshops and poor ICT leadership are categories that gave rise to the mentioned theme. These categories are illustrated and discussed in the next sub-paragraphs.

Category 4.1: Digitally-savvy learners

Many teachers indicated that the nature of today's children and by the virtue of being a digitally-savvy generation compels teachers to use ICT integrated methods of teaching. In supporting this assertion that characterises today's learners one of the teachers stated that:

"Learners nowadays want technology because they are very interested in using computers, more than what is written in the book." (Teacher #7)

"You must use other ways of teaching in order for these kids not to be bored." (Teacher #1)

Cognisant of the knowledge-based society, digitally-savvy children and 21st century skills, one of the high school teachers mentioned that:

"We have noted that the whole world is going the global route. So the challenge is that you can't prevent the child from being a part of the global world. You have to learn the way they live. If I exclude them, it basically means that I am excluding them from being part of the global world. Then I might be making him even educationally poor, so I have to be part of the process of making sure that they become the part that is of the global world in terms of learning." (Teacher #3)

Some teachers considered digitally-savvy learners as a boon in that they also educate their teachers regarding ICT equipment. Teacher #3 further expressed his reliance on his learners:

"I just call learners to show me how to go about using a gadget and without reading the manual or following the instructions and they show me whatever is required."

Contrary to seeing the digital generation as a boon, some teachers feel challenged and become embarrassed if they are unable to use ICT gadgets in front of learners who are digitally literate and can do anything with ICT equipment. Another teacher stated that his learners prefer using ICT for learning rather than reading from a book. This is characteristic of the Y-and the Z-generations and the teacher explained:

"It is a challenge, like I said earlier on, we need to be workshopped more, because it will be so embarrassing if you are supposed to do a programme with the learners, and then only to find that they know more than you. So that is a disadvantage when it comes to us, because we are not well equipped, whereas some of the learners, when it comes to computers they know more than us, it becomes a challenge in that regard." (Teacher #9)

Category 4.2: Time and non-inclusion of ICT in the timetable

Time allocated for a period in an overcrowded class was referred to as another obstacle. A 30-minute period for the number of learners in a class was considered insufficient time when every learner is expected to interact with ICTs. This is illustrated by the following statements:

"More time is needed because we need to sit and arrange learners and go on with my work. It is quite time consuming." (Teacher #2)

"The school timetable does not include ICT but when I have free periods I take learners to the lab so that they can do something. You know children love computers." (Teacher #7)

"Classes are overcrowded and this consumes time as well. The problem is with the school management. The school time-table should include a computer practice period which will be followed by all teachers. This could have had an impact." (Teacher #8)

Category 4.3: Lack of follow-up ICT workshops

All teacher participants with limited ICT skills pointed a finger at the DBE for not providing follow-up workshops to ensure that teachers have mastered the ICT skills required and are integrating ICT in teaching and learning. They referred to the lack of ICT coordinators as an issue that must be given serious attention. The following statements supported the need for more training sessions:

"We need the department to send us people who will conduct more workshops to see if we doing the correct thing. More and more workshops are needed to make sure that we succeed in using computers in teaching". (Teacher #7)

The feasibility of providing intensive training is determined by the availability of funds as alluded to by one participant who stated that:

"More financial support is required for more ICT workshops."
(Teacher #10)

Some teachers blamed the DBE for failing to provide continued workshops and one suggested an ultimatum be issued to all teachers in terms of which they had to integrate ICTs into their teaching practice:

"The District or the Department of Basic Education must prescribe that every teacher must have computer skills by a particular time." (Teacher #4)

Category 4.4: Poor ICT leadership

The school leadership is described as the engine that runs the school including the assurance that all ICT related issues function as intended. Many teachers identified the lack of knowledge and ignorance of issues pertaining to the use of ICTs for teaching and learning as well as the lack of support from the school leadership, especially the principal, as factors that discourage those teachers who are using ICTs for teaching and learning. The concerns expressed were as follows:

"The person who is in charge does not open the computer lab and that the internet is used by the principal and the School Management Team." (Teacher #1)

"Some teachers confirmed that all Heads of Department (HODs) have computers in their offices but only a few use them. They just lock them in the strong room and spend even more than a week without taking them out of the strong room". (Teacher #8)

The school principal's role as an instructional leader and administrator is said to be more evident than that of ICT leader at school.

"Our school principal does not know anything about what is happening in the computer lab but he accepts any information we relay to him. You know, I don't blame him because principals are always busy running the school. Our computer laboratory [IBM] *is dilapidated and the walls have big cracks. Some things like encouraging teachers to learn and use computers, training teachers, maintaining the computers and the*

building require the principal and DBE. The department [DBE] *must make computer labs functional.*"(Teacher #7)

5.5.2 Themes emerging from principals' data analysis

The analysis of data obtained from the principals' interviews elicited categories and themes some of which are similar to those which emerged from teachers' data. The themes which emerged from the principals' information are discussed in the next section.

5.5.2.1 Theme 1: Acknowledgement of the role of ICTs in teaching and learning.

All principals acknowledged the important role of ICTs in teaching and learning and further indicated that ICTs are indispensable in the 21st century teaching and learning. The categories that gave rise to this theme were: ICT use in teaching and learning is indispensable in the digital era, teachers' community of learning and the nature of today's learners. These categories are dealt with next.

Category 1.1: ICT use in teaching and learning is indispensable in the digital era

The principals' data indicated that the present digital era prescribes that teachers and learners should use ICTs in teaching and learning. All principals highlighted the value of ICTs in teaching and learning and pointed out the shortcomings of the traditional teaching methods. This category is captured by various responses from the five principals, illustrated as follows:

> *"GDE is over-ruling the chalk and talk and the authorities are emphasising that all schools in Gauteng should introduce and use computers and tablets."* (Principal #1, See appendix K)
>
> *"Learners want to learn more about the computers and all learners enjoy to be in a computer laboratory because they are free and work well in groups of two or three." (*Principal #2)

"Lessons are prepared and ready for presentation in class by teachers. On a computer learners are able to see experiments happening and it arouses interest and makes them to understand and to compare much better." (Principal #3)

"There are companies that want to see our learners using computers and that is due to the fact that our school is in an area of the poor of the poorest. It is our wish that they are not left behind, as children they love technology and they must have the chance to use computers and tablets like learners in the suburban schools. In addition to that, ICTs assist learners to do their work in a very quick way." (Principal #4)

"Children in higher grades like Grade 6 and Grade 7 are enabled to do research using the internet and smart cell phone." (Principal #5)

Category 1.2: Teachers' community of learning

Principals emphasised teachers' participation in various forums of communities of learning; hence online discussion surfaced as one of the expectations of every teacher in order to interact with other teachers, share experiences, update others with current information and help those teachers who are having challenges in terms of the subjects they teach. This is highlighted by the following statements:

"Every educator must have his or her own laptop to be able to communicate online, to solve problems online and do everything online." (Principal #5)

"Physical Science and Maths teachers can communicate with teachers from other schools using social media, emails and online discussion to empower one another." (Principal #3)

Category 1.3: The nature of today's learners

Teachers cannot avoid ICTs in teaching their learners due to the fact that their learners are inspired by ICTs and are accustomed to using these gadgets for communication, searching and gathering information and for writing activities. The traditional methods of teaching no longer have a place in the 21st century education because learners prefer to be taught according to their own preferences and styles. The statements that support the digital nature of today's learners are as follows:

> *"For our learners, using a computer is better because learners can see pictures, it is audio at the same time unlike in the olden days."* (Principal #1)

> *"The kids* [learners] *love to be in the computer room and they perform better than when they are in an ordinary classroom where they are taught in the traditional way."* (Principal #2)

5.5.2.2   Theme 2: Ineffective use of ICTs in teaching and learning

All principals acknowledged that the available ICTs in schools were not effectively utilised. The impracticality of computer usage in teaching and learning at school, digitally unskilled teachers, security measures and poor support for effective ICT integration are categories that constituted this theme. These categories are discussed in the subsequent headings.

Category 2.1: The impracticality of computer usage in teaching and learning at school

Cognisant of policy stipulations, schools are not able to effectively integrate ICT due to the inadequate number of computers available at a school. Principals expressed their inability to make ICT work at their schools. The following utterances were made in this regard:

> *"It is still difficult to enforce this policy because as you can see ma'am,*
> *the number of computers, the ratio of computer per learners, I have*

got a roll of 1300 learners and then only 25 computers in the school.
That means that one child can use computer may be once a week. Or
sometimes even after three weeks. So it is not feasible for now unless
you know we had a bigger computer lab for each and every class. I
mean 1300 learners for 25 computers, they are not sufficient and
sometimes we do have problems of the network not working and then
whereby you find the computers are not working for a month or two."
(Principal #1)

The emphasis on inadequate ICT infrastructure was echoed by Principal #3 who explained that:

"We do have facilities but not adequate enough to cover everybody but
at least we do have equipment." (Principal #3)

The same concern is reiterated by another principal who mentioned that:

"ICTs must be used in all learning areas. However the major hindrance is
*the inadequate number of computers and tablets." (*Principal #2)

Category 2.2: Digitally unskilled teachers

Teachers are portrayed as educational partners without whom ICTs cannot be effectively utilised in the classroom situation. The high level of ICT proficiency enables teachers to integrate ICT to yield the desired capabilities of ICTs in providing better teaching and learning opportunities. However, lack of digital literacy among teachers renders the availability of ICT infrastructure null and void as the equipment cannot be used to improve teaching and learning. Principals expressed that many teachers are not using ICTs in teaching and learning due to the fact that they are not digitally literate. The following are the indicators of this category:

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"We are having a computer laboratory which is just a white elephant, it is not fully functional as most of the teachers can't even use a computer."(Principal #4)

"I have noticed that teachers are not interested in using ICTs and that is because they lack ICT skills. That is the major problem." (Principal #1)

"Most of the teachers are afraid of computers because they have not been trained." (Principal #2)

Category 2.3: Security measures

One of the biggest challenges that township schools face is burglary and theft of ICT equipment from schools; this impedes the effective utilisation of ICTs. The principals' experience of criminal acts was referred to in this manner:

"Our tablets were taken by thieves in day broad light robbery but the security guards feared for their lives because they did not have guns."
(Principal #2)

Some principals have taken measures by installing security alarms and notifying learners and parents of the danger of attempting to break into the computer laboratory. This has helped in securing the school ICT facilities. This is attested to by principal #1 who stated:

"We have involved the service provider like Chubb and ADT to install alarm systems and our children know that is a no go area."(Principal #1)

Category 2.4: Poor support for effective ICT integration

Teachers' data indicated that the ICT proficiency level of many teachers is at entry level and it is apparent that those teachers need more training to empower them with the necessary skills. All principals reiterated that they require support in terms of more training

workshops for professional development of teachers and themselves, technical staff to help teachers and funds to procure and facilitate whatever is needed. The statements mentioned below are indicative of this category.

> *"We are lagging behind as teachers and as principals, we need more workshops. More funds are needed since parents are not paying much towards the school fees. There should be enough budgets in order to organise a workshop and refreshments for these people* [teachers]." (Principal #1)

> *"The Government must introduce programmes which will require all teachers to be fully trained for six months or one year."* (Principal #2)

> *"The maintenance people come once in six months to check if the computers and the network are functional. If we can get funds or get people to come forward and train teachers."* (Principal #3)

5.5.2.3 Theme 3: Inability to recognise ICT leadership role

Literature (Kannan *et al.,* 2012:111) mentions that schools which excel in integrating ICT are those where the principals are embracing the potential of technology to improve teaching and learning and are modelling the use of ICTs. These research findings convey that the sustainable use of ICTs by teachers and learners depends on the principal who has an interest in ICTs and is of the same opinion that ICT do improve teaching and learning. ICT innovative principals fulfil obligatory ICT leadership tasks which ensure success of ICT usage at school.

In this study most of the principals indicated that many other principals are unaware that they automatically assume the role of ICT leader in a school by the virtue of the principalship and the availability of an ICT infrastructure in a school. This theme is characterised by the following categories: unfamiliarity with Provincial and National ICT in

education policies, lack of ICT vision, absence of school-based ICT policy, non-performance of ICT tasks.

Category 3.1: Unfamiliarity with provincial and national ICT policy in education

It emerged from these responses that some principals knew very little or nothing about the eLearning policy and strategic planning.

In spite of teacher expectations, very little if anything was done by these principals to encourage ICT integration nor was there any evidence of leadership in the use of ICTs. According to Principal #3 his enforcement of national ICT policy included: "*Encouraging my teachers to use computer labs and I also make sure that there is a least one period per week for every grade.*"

Category 3.2: Absence of school-based ICT policy

All principals acknowledged the importance of policy in all school matters. However, none of the principals had a school level ICT policy which was confirmed by the following comments:

> "*We haven't as yet established a policy on ICT.*" (Principal #1)

> "*We don't have anything* [school-based ICT policy] *regarding ICT."*
> (Principal #2)

One of the five principals indicated his school was operating according to the policy initiatives but when the researcher asked for the policy document, it was never produced. Absence of ICT policy at school level is indicative of the fact that ICT integration is heeded only by teachers who take an interest in ICTs for teaching and learning, while other teachers are exempted from integrating ICT into their teaching activities. Absence of school-based ICT policy implies a lack of vision and as a result the use of ICTs at school is not regarded as compulsory and not worth striving for. Lack of policy implies ignoring some

of the important responsibilities and compromising the quality of education. Policy helps in regulating whatever practices should be upheld.

Category 3.3: Non-performance of ICT tasks

All principals attributed non-performance of ICT tasks to the lack of skills and not knowing what they should do as ICT leaders at school. Principal #1 mentioned that "*the only problem I have noticed is lack of skills and we are lagging behind.*" To equip teachers and principals in terms of ICT skills, Principal #1 further emphasised *"We need more workshops".*

From the responses provided by principals it was observed that all principals embarked on only one task: encouraging teachers to be ICT literate. Other than that, no other ICT task was performed by school principals and this constitutes a major problem. As one of the principals who use ICT, Principal #2 highlighted the need for the school community to become ICT literate in order to manage the school efficiently and to achieve ICT educational goals.

Consistent with Principal #1's comments on training, Principal #2 endorsed the training of principals, teachers and parents stating:

> *"The training should start from the top and the principals be the first to be trained then be followed by the training of teachers and lastly the training be cascaded to parents especially those who are SGB (School Governing Body) members in order to empower them".* (Principal #2)

The principals identified the disjuncture between theory and practice and Principal #4 confirmed the disconnection and said:

> *"I think in principle the policy is correct, but practically how can learners be ICT equipped while teachers are not equipped, because most of the teachers for instance in our institution we are having 42 teachers and only a few are ICT equipped".*

Principal #5 attributed lack of ICT skills to the fact that *"ICT to most of us [principals and teachers] is foreign"*. Principal #3 bluntly stated: *"Older teachers* [including principals] *have technophobia."*

In addition to interviews as a data acquiring method, the researcher engaged in non-participant observation which is discussed in the next section.

5.6 NON-PARTICIPANT OBSERVATION

The researcher engaged in non-participant observation by watching the ICT situation in the selected schools and observed the behaviour of the participants. The purpose for non-participation observation was geared at supplementing the empirical information in order to gain an in-depth understanding of teachers' views of ICT integration in urban schools. The use non-participation observation helped the researcher to determine the extent of ICT usage in a school, the behaviour and impression of the teachers and the school leadership in terms of ICT introduction to improve education effectiveness. All information obtained from the observation was written down as notes for further analysis and comparison with data obtained by means of using the interviews and the content analysis.

Information from non-participant observation by the researcher indicated the following:

- High schools were resourced with ICTs such as the computers, tablets, projector, white boards and televisions as compared to primary schools which had only computers, tablets and internet connectivity.
- Computer laboratories at some primary schools were locked and when access to those laboratories was gained, it was discovered that the computer classrooms were used as storerooms with piles of books packed everywhere.
- Computer laboratories in some primary and high schools were under the control of one or two teachers who used ICTs in teaching but the other teachers were not interested in using the laboratory and did not know what ICT equipment was available.

- High school learners were using the computers during break and after school hours where learners worked on their own or in groups.

- In one primary school the computer laboratory's walls had big cracks and the laboratory had been abandoned because of its dilapidated state. The computers were gathering dust as they were not used for teaching and learning.

- The number of computers found in certain schools indicated that some had been stolen and not replaced.

- Broken computers were not repaired.

- Some principals preferred not to be interviewed since the phenomenon under investigation was ICT related even though principals are designated ICT leaders in terms of educational policy. They suggested only teachers be interviewed.

- The schools had internet connectivity but at the time of the empirical investigation GoL connectivity was about to be suspended. As a result a sense of frustration and uncertainty overwhelmed most of the teachers and principals.

The information yielded by observation indicated that there were more challenges than benefits. The number of computers and tablets in two high schools per institution were one hundred and five (105). According to the researcher's opinion and in spite of the availability of ICT tools, the number of learners during any designated period for a particular subject out-numbered the number of computers. This demonstrates the shortcomings on the accessibility of these computers at schools. Through interviews, the data extracted highlighted the high enrolment of learners in comparison to the number of computers. The negative attitude of some teachers to incorporating ICTs as part of their teaching intervention, damaged and faulty computers, unreliable internet connectivity and the principals' attitude surfaced during the interview process. These issues are highlighted in the reviewed literature (Mac Callum *et al.*, 2014:144; Nkula and Krauss, 2014:245) in Section 3.7 who emphasised the same challenges in the research undertakings. The observation and interview data confirms Ndlovu and Lawrence's (2012) findings that some South African schools are not using ICTs despite availability.

The education authorities, schools, private companies, school leadership and parents should consider these challenges as a matter of urgency and devise strategies that will solve some of the problems related to ICT use in teaching and learning since the use of ICT in schools is progressing and continuously evolving. Teachers are key figures in the process of teaching and learning. It is a concern when teachers are reluctant when it comes to the incorporation and usage of ICT in the classroom. The documents analysed (Lesufi, 2014:7; GDE, 2011:17) speak to such challenges and focus on initiatives to emphasise the presence of ICT coordinators and ICT experts to provide more practical training interventions in effective use of the ICT tools in the pedagogic milieu.

The researcher of this study is of the opinion that with suitable interventions, teachers will proactively change and challenge their beliefs in relation to the usage of ICTs as enablers of effective and efficient learning. It is through the implementation of these practical interventions and support mechanisms that traditional beliefs in respect of ICTs will be challenged, and perceptions changed as teachers' horizons broaden. The observations about the way in which learners used and interacted with computers was confirmed and substantiated throughout the interviews with teachers and principals. The same interaction is supported by researchers such as Chigona *et al*. (2014:5) as discussed in Section 3.4 of Chapter 3.

In addition to the interviews together with non-participant observation, document analysis was the third data collection method used to get more information pertaining to teachers' use of ICTs in their pedagogical activities. The other reason for using more techniques for data collection was for triangulation purposes. Triangulation in this study was of significant importance in terms of testing, verifying, comparing and corroborating research findings yielded by each data collection method. The analysis of contents in various documents is discussed in the next section.

5.7   DOCUMENT ANALYSIS

'Document' refers to a wide range of written, visual and physical materials that have been developed and recorded without the researcher's intervention. Documents are also

referred to as the social facts which are produced, shared and used in socially organised ways. These documents can be personal or official documents which include notes, letters, advertisements, diaries, tax records and receipts, maps, journals, newspapers, memoranda and official minutes (McMillan and Schumacher, 2010:361; Bowen, 2009:27). Both personal and official documents are used to provide information for the evaluation of phenomena in a research study.

Document analysis is defined by Bowen (2009:28) as a systemic procedure for reviewing or evaluating the printed and electronic material with the intention to elicit meaning, to gain a deeper understanding of the contents and to develop empirical knowledge. The document analysing process requires the analyst to skim, read for thorough examination of the content, interpret and assign meaning. Consequently this analytical process involves thorough reading and understanding the content, synthesizing the information contained in the documents and culminates in organizing themes and categories for units of study.

In considering the main intention of this study, the researcher needed to understand teachers' perspectives and experiences on the use of ICTs in teaching and learning in urban schools. The researcher therefore used national and provincial ICT policy documents, guideline documents, reports, news reports and magazines on ICT matters in teaching and learning in order to gain an in-depth understanding of teachers' views and perspectives on ICT usage in teaching and learning. The school level ICT policies which are of significant importance in enforcing the ICT culture were not available as they were non-existent in schools. The selected documents were chosen as sources for the provision of data due to the fact they indicate the rationale for ICT usage, the planning background for the introduction of ICTs in teaching and learning, and the challenges that overshadows the full utilisation of eLearning in the South African public schools.

The table below illustrates the documents and the data analysed in the selected documents.

Table 5.4: Documents and data analysed

Documents selected	Data analysed
DBE's Progress with ICT Integration in Schools 2015	Policy goals, strategic objectives for effective integration of ICT into teaching and learning, challenges and the way forward
Education South Africa (SA) Magazine 2014	Improving education with technology
eLearning Solutions Project 2007	eLearning goals, national e-education initiatives and the implementation strategy
Engineering News 13/11/2015	Appropriate use of ICT in classrooms seen as helping improve SA's education
Guidelines developed by the eLearning Directorate 2011	Using ICTs to support teaching and learning Teachers' training and confidence Management responsibilities Timetabling
Guidelines for schools ICT Hardware Specifications 2012	ICT requirements; recommendations for ICT in schools
Guidelines for Teacher Training and Professional development in ICT 2007	eEducation and CAPS implementation Teacher ICT knowledge, skills, values and attitudes Development levels
Information and Communication Technology (ICT) in Education in Sub-Saharan Africa: A comparative analysis of basic eReadiness in schools 2015	Provision of ICT infrastructure Teacher capacity ICT affordances and challenges
National Education Collaboration Trust (NECT) Interim Integrated Report 2014	Development of ICT strategy
Sci-Bono Discovery Center Annual Report	Message from Gauteng MEC for Education Teacher training and development
Status Report on the implementation of E-Education 2013	ICT infrastructure Teacher training and Professional

	development
	Challenges to ICT implementation in schools
The five year 10 Pillar Education Programme: Presentation for the MEC's Consultative meetings 2014	Pillar 6: ICT in Education Introducing smart classrooms
White Paper on eEducation: Transforming Learning and Teaching through Information and Communication Technologies 2004	The use of ICTs in education, the policy framework and eEducation goal, Strategic objectives, Funding, Resourcing and Implementation strategies.

5.7.1 The approach used in document analysis

In this study the researcher used a deductive approach to qualitative document analysis based on the themes that emerged through category and thematic analysis of teachers' and principals' interview data. The use of predefined themes and codes was of significant importance for triangulation purposes, to determine convergence and corroboration of findings from the interview data, the content analysis and non-participant observation. The themes and their categories from the identified and relevant text passages are mentioned in the following section.

5.7.1.1 Theme 1: Provision of ICT infrastructure

The provision of ICT infrastructure is one of the strategic objectives and conditions needed for effective and successful ICT integration at schools. In compliance with global trends and the new educational imperatives, the creation of smart and paperless classrooms in all Gauteng schools is regarded as of great importance to:

> *"ensure that all learners and teachers have progressive access to broadband and innovative learning and teaching tools which will enable learners to meaningfully participate in the economies of the future"* (Lesufi, 2014:5-6).

This assertion is in unison with the policy stipulation to:

"Increase access amongst learners to a wide range of media including computers, which enrich their learning" (GDE, 2007:1).

These statements indicate the commitment of the GDE to transform teaching and learning with the implementation of ICT as "*a core resource for teaching and learning*" (Sci-Bono, 2015:5).

This theme was characterised by the following categories indicated in the subsequent paragraphs.

Category 1.1: Insufficient number of computers

The South African government through its Provincial Education Departments and in partnership with the private sector provided the ICT tools and platforms across the education system in order to facilitate teaching and learning with various ICT tools. Mnisi (2015:2) reported that 30% of the ICT initiatives addressed ICT infrastructure strategic objective. In accordance with this statement, UNESCO (2015:7) documented that:

"60% of South African primary schools have computers for teaching and learning but are not sufficient as policy emphasised provision of ICTs in all schools and for all children in all subjects of the curriculum."

The Status Report on the implementation of e-education (Mweli, 2013:5) states that 63% of Gauteng schools have ICTs for teaching and learning. GDE (2007:7) further states that:

"GDE was successful in providing ICT tools in schools and that 1538 schools have benefitted from GoL project although both sources admit that there is much that still need to be done in terms of providing mobile ICT resources that have the potential to support and enhance teaching and learning."

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The inadequacy of the ICT infrastructure was highlighted by the South African President who stated that "*the pace of providing technology and connectivity and integrating these into teaching and learning has been slow and inadequate*" (Engineering News, 2015:3).

The educational authorities convey the same sentiment and acknowledge that one computer laboratory to each school is not sufficient to address the requirements for curriculum integration as the resources are to be shared by hundreds of learners (DBE, 2012:12). The insufficiency of 1300 iPads distributed to 25 schools by the private sector in the Peermont School Support Programme (PSSP) is identified here, although the gesture is highly commendable for providing learners with access to quality education and life skills activities (Education SA, 2014:28).

To combat computer insufficiency, GED (2007:9) states the importance of moving ICTs into the classroom and giving every teacher a laptop with 3G facilities. In terms of internet connectivity, DBE states that:

> "*Every teacher and learner in the GET (General Education and Training) and FET (Further Education and Training) must have access to an educational network and the internet*". DBE (2004:31)

As far as connectivity issues are concerned, the Status Report on the implementation of eEducation notes that despite the provision of internet connectivity to many Gauteng schools through various projects, limited and unreliable connectivity network for the schools is still a major stumbling block (Mweli 2013).

To ensure access to regular internet connectivity, Gauteng MEC for Education with Tshwane Municipality made free Wi-Fi available to more than 300 schools in Tshwane in order for teachers and learners to access information related to their curriculum needs (Lesufi, 2014:7).

Category 1.2: Lack of educational software

The curriculum software loaded in GoL computers is intended by GDE (2007:10) for teaching and learning in the Foundation and FET phases and cover the following subjects: English, Sciences, Geography and Accounting (GDE, 2007:10). Clearly not all the subjects in the curriculum are catered for and the application of ICTs is limited corroborating concerns about the lack of software for indigenous South African languages especially since these languages are the home language of many learners in the urban schools. In addition, English is the dominant language of the internet and most educational software packages are in English. This has an adverse effect because many teachers and learners are not first language English speakers and the language barrier prevents the effective use of the available ICTs. In an attempt to overcome the lack of local content software, the DBE together with the Department of Arts and Culture stipulated its commitment to promote the development of local content into indigenous languages (DBE, 2004:28).

Lack of educational software in South African schools is alluded to by Hart and Laher (2015:2) and GDE (2007:11) who state that the digitised curriculum content does not cover all grades. In spite of connectivity challenges, DBE (2015:2) commits to establish a DBE cloud with other government departments to make free content available for every person in South Africa. Lack of educational software is a big concern to many schools in Gauteng; however, the PSSP schools are provided with iPads loaded with everything that learners need for their lessons (Education SA, 2014:28).

Category 1.3: Limited ICT classroom space

eLearning Solution indicates that Gauteng Primary Mathematics and Literacy Strategy (GPMLS) and Senior Secondary Improvement Programme (SSIP) schools have eLearning periods for teachers and learners to implement eLearning. (GDE, 2007:22). However, the 25 computer ICT laboratory is designed and sufficient to accommodate 25 or fewer learners. Lack of scheduled eLearning periods shows ineffective eLearning usage which is seen to be the result of lack of time and building space.

Shortage of ICT classroom space is identified as a challenge that inhibits the successful utilisation of technology (Mweli, 2013; GDE, 2007:10). The high learner-computer ratio is described as a disservice to education and as a result computer laboratories are viewed as obsolete while mobile ICT equipment with mobile internet are procured in order for all learners to experience enhanced learning opportunities (UNESCO, 2015:15).

Category 1.4: Electricity supply

UNESCO (2015:12) and DBE (2004:31) report that three-quarters of South African primary schools have electricity and Gauteng is one of the South African provinces with well-established ICT infrastructure and all schools have electricity. In spite of this milestone, all schools experienced problems when affected by power cuts which had a negative impact on the use of ICTs and the network. The consequences of power interruptions impede the reliable use of ICTs and hamper educational progress as teachers are prevented from performing their ICT pedagogic activities and learners are robbed of the opportunity to attend computer classes and experience effective and innovative learning (UNESCO, 2015:11; DBE 2012:13). The interview data on power cuts is alluded to by Teacher #8 in the following response:

> *"If there was a power failure in the middle of the class, learners will lose all their work which was very discouraging and the class was unable to continue".* (Teacher #8)

In countering the irregular electricity supply, the installation of solar powered elements and solar powered classrooms is encouraged. Sci-Bono in partnership with DELL commits to such installations in disadvantaged communities to enable learners to have uninterrupted ICT access (Sci-Bono, 2014:26).

The documented efforts to improve electricity supply corroborate the interview findings which highlighted challenges experienced as a result of power cuts and poor electricity supply and the negative effect it has on the teachers who are eager to use ICTs for teaching and learning. It is therefore necessary for local governments to ensure availability of

electricity during school hours or provide schools with generators to supply power in case such unfortunate circumstances arise. DBE and the school management have to ensure that adequate funds are provided to avoid power cuts warranted by unpaid accounts.

5.7.1.2   Theme 2: Teachers' ICT proficiency level

The provision of ICT infrastructure coupled with ICT proficient teachers is required for the realisation of effective ICT usage in teaching and learning. This is confirmed by GED's stipulation that:

> *"eEducation requires that teachers, managers and administrators in public schools have the knowledge, skills and the support necessary to integrate ICTS into teaching and learning"* (GDE 2011:11).

The use of ICTs is said to be determined by the school's eReadiness and eMaturity and five ICT proficiency levels are identified as shown in Figure 5.1.
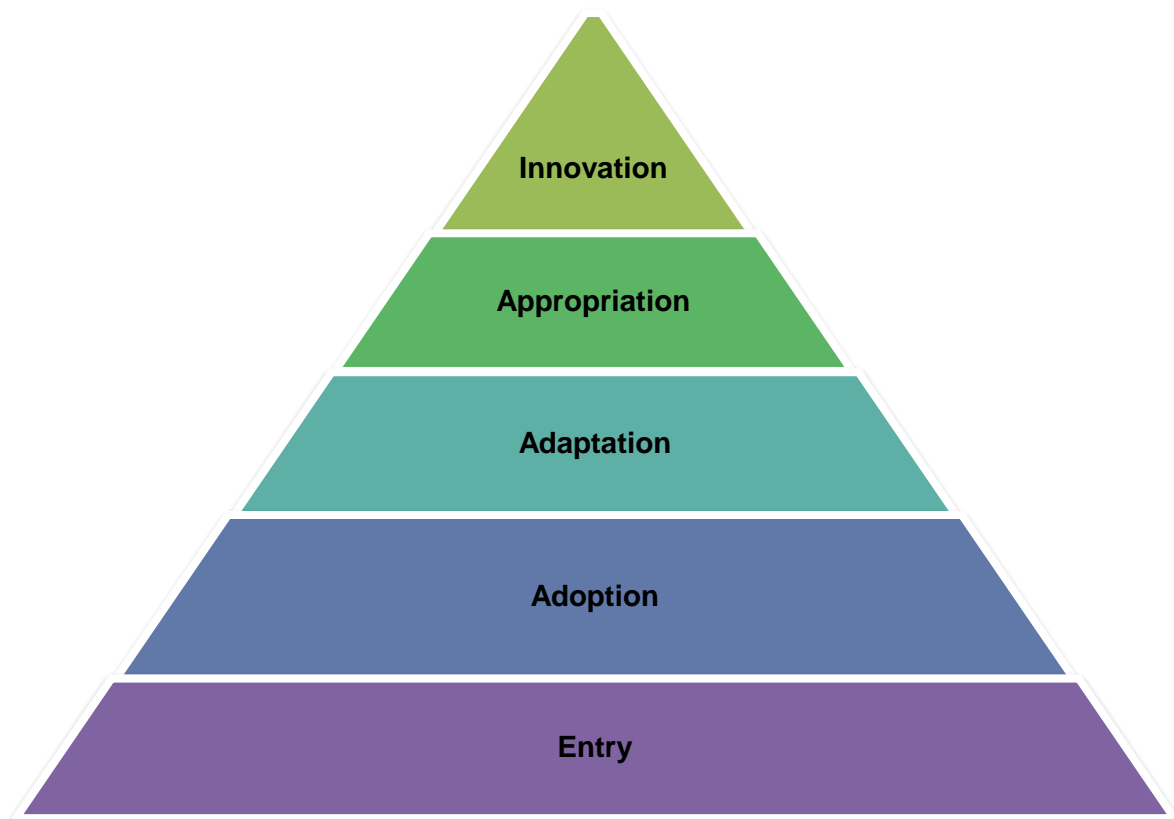
Figure 5.1: Teacher ICT proficiency levels adapted from DBE (2007:7)

Entry is the starting or basic level in ICT proficiency; adoption refers to accepting or taking on ICT; adaptation is when a teacher is able to integrate ICT into teaching and learning; appropriation occurs when a user takes ICT on for their own use; and innovation refers to the highest level where users can specialise and innovate in ICT in education.

Three categories are identified to have a bearing on teachers' proficiency with regards to ICT usage in their teaching practices. All teachers have to be on the adaptation level in order to integrate technology, teaching methods and teaching content for effective teaching and learning to take place (GDE 2011:16; DBE 2007:7). The interview information indicated that the majority of teachers are on the lower level of ICT proficiency skills. This is substantiated by the Teacher #2' response with regards to his ICT proficiency:

"*When I trained as a teacher, we did not have computers. I discovered a computer lab when I got employed in Mamelodi. I do not know how to combine computers and the teaching method. But I can use a computer for typing and searching information on the internet*". (Teacher #2)

Category 2.1: ICT skills

The President's statement, the Gauteng Premier, Gauteng MEC for Education (Engineering News, 2015:3) and the Status Report on the implementation of eEducation (UNESCO, 2015:20; Mweli, 2013) recognise the necessity of teachers having the skills and ability to integrate ICTs in teaching and learning as low levels of ICT skills impact on the teaching and learning. According to DBE (2004:25), the ICT professional aptitude and the required ICT skills include, among others, awareness of different application software, availability of content from various sources, the ability to use ICT to support and enhance everyday classroom activities, knowing when and when not to use ICT to achieve teaching and learning outcomes, the ability to reflect and adapt teaching strategies using ICT, use ICT to support teaching and learning, provide help and support to learners and other teachers and to understand the significance of ICTs in communication and collaboration in teaching and learning.

Teachers' opportunity for participation in online communities of practice to share knowledge with other teachers is given more emphasis. GDE (2007:11) attributes lack or poor use of ICTs in schools to inadequate ICT skills in the majority of teachers at entry level and stipulates the adaptation and the appropriation levels to be the ICT expertise requirements to be reached by the majority of teachers who have ICTs at their schools.

Category 2.2: ICT Training

Mweli's report (2013:18) states that the Provincial Departments of Education (PDEs) are liable for the training and development of teachers in ICT skills and the integration of ICT in teaching and learning. The commitment of providing continual professional development is referred to by stipulating that all levels of eLearning are continuously being developed in various ICT programmes to ensure proper usage of ICTs (GDE, 2007:8). Mweli (2013:18) puts the number of trained teachers at 12 000 and acknowledges the low percentage of teachers who attended the training. GDE (2007:24) confirms 12 000 teachers have received training in basic ICT skills and the use of tablets.

The teacher development training framework identifies five levels of expertise (entry, adoption, adaptation, appropriation and innovation) and maintains that the in-service teachers should be trained to the adoption level which means they should have the knowledge and skills to use a computer and application software. In addition, teachers are expected to be able to use various ICT applications and teach learners how to use it. According to DBE (2007:7), 60% of teachers who have access to ICT should be at the adoption level and through continuing professional development in institutions of higher education, they should acquire more ICT knowledge and skills in order to reach the advanced levels.

In partnership with GDE various organisations are engaged in training sessions to equip teachers with the necessary skills to reach the required levels of expertise. INTEL, SCOPE, Telkom, SchoolNet, Vodacom, Sci-Bono and DELL are some of the institutions that offered ICT training to teachers from various schools in Gauteng (SchoolNet, 2015:3). Emperors

Palace and PSSP Initiatives (Education SA, 2014:28) have provided comprehensive training for effective ICT integration to a small number of teachers and some trained teachers were designated as iPad champions and had to train other teachers (Education SA, 2014:28). In an attempt to have all teachers achieve the adoption level and beyond, NGOs are continuing to offer accredited courses on ICT skills for teachers and school principals and to certify them on completion (SchoolNet, 2015:8 and 18).

National Education Collaboration Trust (NECT) (DBE, 2014) believes the various ICT interventions are problematic in that they are implemented without a common vision or implementation strategy. The President echoed that poor ICT integration in teaching and learning is attributable to fragmented ICT initiatives characterised by a lack of centralised coordination (Engineering News, 2015:3). It is important for the DBE and PDEs to consolidate a single ICT vision, develop a coherent and affordable implementation programme to achieve ICT educational goals (DBE, 2014:38).

Category 2.3: Teacher confidence

ICT in education documents postulate that one of the responsibilities of the teacher is to make sure that they are digitally literate and learn how to use ICTs in pedagogic situations so that they can educate using the technology with confidence (Education SA, 2014:30; GDE, 2011:16). Efficient ICT skills and integration literacy are regarded as of utmost importance in developing teacher confidence with regard to ICT integration and implementation in teaching and learning. GDE (2011:17) and the DBE (2007:6) identify lack of confidence as one of the factors which results in limited and unsuccessful ICT integration due to the fact that the majority of teachers' ICT skill level is at entry level. The low level ICT skills are identified as the source of frustration and insecurity experienced by teachers in terms of ICT integration. Acknowledging the lack of ICT skills and lack of confidence in teachers, the Gauteng MEC for Education reiterated his reliance on Sci-Bono for teacher training and accreditation in order to build teachers confidence and to support GED's ICT Solution Strategy (Sci-Bono, 2015:5).

Teacher development with regard to ICT use has political approval from the President and the Gauteng Premier to afford teachers with the training that will enable them to become competent, confident and knowledgeable and able to use ICT to enhance teaching and support learning. Online participation in communities of practice is another way of exhibiting confidence and provides the opportunity to share and distribute knowledge which helps strengthen teachers' content knowledge (Engineering News, 2015:3).

In building teachers' confidence, various role players and experts are required to make ICT-related presentations that will be eye-openers for teachers' with low expertise level. The various presentations can support effective teaching and learning and capacitate teachers with necessary ICT expertise to enable them to use ICTs effectively (Lesufi, 2014: 7). GDE (2011:17) emphasises the need for an ICT coordinator in schools and for providing more practice and additional training in the use of ICT tools. The help of curriculum experts is essential in attaining integration literacy among teachers.

Category 2.4: Lack of ownership and better insight at school level

One of the documented weaknesses pertains to lack of ownership and better insight into the infiltration of ICT into the pedagogic practices. This is illustrated by Hart and Laher (2015:3) who mention that the majority of teachers are still not conversant with computers, either for lesson preparation or integration into their teaching, despite their participation in basic skills training offered by the DBE. Older generation of teachers' poor ICT skills, lack of confidence and motivation in incorporating ICTs in teaching and learning are said to have resulted in teachers neither accepting nor taking ownership of the best use of ICTs availed at their schools (GED, 2007:12).

Hart and Laher's (2015) findings were confirmed by interview findings which indicated that the majority of the primary school teachers in this study reiterated that although they want to integrate ICTs for teaching and learning, they did not have the ICT skills to enable them to do so. This indicates that teachers' proficiency level is not at the appropriation level which is the required level as described by DBE. The observation that many teachers at the participating schools do not even frequent the ICT laboratory highlights that they are not

knowledgeable in terms of the three knowledge areas, their relationship and the importance of their interconnection for teaching and learning.

The researcher therefore presumed that teachers' ICT proficiency level is at the entry level as indicated by DBE's assertion. In order to overcome the national teachers' ICT proficiency challenges, the training of South African teachers should be premised on the South African ICT in education context. In addition the development of school's ICT committees and making slots in teachers' timetables to compel teachers to use ICT tools in all subjects are measures that will assist teachers in building positive attitudes and appropriating technological innovations at school level.

5.7.1.3   Theme 3: ICT benefits in teaching and learning

The South African government with its national goal of achieving a knowledge-based society states that the education system is obligated to develop a citizenry that can actively participate in the network and global arena and deliver quality education for economic and social development.

In line with this obligation, the introduction of ICT in the teaching and learning environment is commendable for the transformation of the teaching process by utilising new teaching methods and making learning an interactive and creative process for all learners. This theme emerged as a result of the documented information as shown in the next sub-paragraphs.

Category 3.1:   Improve teaching through the use of ICTs

GDE's eLearning Action Plan Goal 16, which aims to improve professionalism, teaching skills, subject knowledge and computer literacy of teachers throughout their entire careers is instrumental in enabling the GDE and its schools to ensure that ICTs are harnessed to transform teaching and learning in Gauteng Province. The major rationale for ICT use in teaching and learning is expressed in the GDE vision which encapsulates the significance of ICTs in the schooling system and later in adult work life. The aim of using ICTs is to ensure

that quality teaching occurs on a daily basis to ensure that every learner does well at school and in post-schooling years learners leave the school with the knowledge, skills and qualifications that will give them the best chance of success in adult life (GDE, 2007:3).

The importance of ICTs for teachers is that they enable teachers to effectively manage their work: they can work faster, collaborate, acquire, share and distribute knowledge to other teachers in their communities (UNESCO, 2015:16). The feasibility and actualisation depends on the developing teachers' ability to use ICTs effectively and efficiently to enhance teaching strategies. This implies the use of better teaching methods and facilitation that are essential in the development of the future self-programmable workforce.

Category 3.2: Enhancement of learning through ICTs

The culmination of the above mentioned Goal 16 is eLearning Goal 20 which aims to increase access amongst learners to a wide range of media, including computers, which enrich their education and is critical in encouraging a flexible and independent approach to knowledge acquisition.

By interacting with ICTs, learners are presented with a variety of options such as using the internet for research, solving problems, collaborating inside and outside school and referencing e-books, all of which can be employed to achieve educational objectives and 21st century skills. On-line assistance through collaboration platforms are of great importance in supporting learners (GDE, 2007:19).

Category 3.3: The realisation of the future workforce

The use of ICTs in teaching and learning is said to be in line with the National Development Plan (NDP) which focuses on the radical economic and social development as explained in the ICT in education documents (Engineering News, 2015:2; Mnisi, 2015:1). With optimal ICT integration in schools, GDE envisions school leavers who are equipped with knowledge, skills and qualifications that will give them the best chance of success and render them employable in their adult life and the corporate world (GDE, 2007:3). ICT-competent

teachers are essential for the GDE to enable young people to access information on careers and to produce ICT-skilled young people to enter the world of work. The desire to produce ICT-skilled learners is in line with the GDE's ICT vision which entails ensuring every learner does well at school and leaves our institutions with the knowledge, skills, and qualifications that will give them the best chance in adult life (GDE, 2014:3). In agreeing with this assertion Mweli (2013:4) states the use of ICTs is aimed at producing ICT capable users in order to develop the skills and knowledge they need to achieve personal goals and to be full participants in the global community and eventually play a role in the economic growth of the country.

5.7.1.4   Theme 4: Challenges of ICT in education implementation.

Full utilisation of eLearning is said to be hampered by factors which are personal and material to the school leadership, teachers and learners. Teachers' attitudes, the lack of leadership from principals in implementing ICTs, lack of people who support ICT integration, and lack of funding for ICT integration in teaching and learning were factors that were selected in the documents for scrutiny.

Category 4.1: Teachers' attitudes

Teachers in educational situations are important partners without whom teaching and learning cannot happen as intended. However lack of knowledge results in negative attitudes to educational technology (Hart and Laher, 2015:2). Age is a big determinant of ICT usage among teachers, and Hart and Laher (2015:3) further state that the older generation of teachers who do not understand the value of ICTs in teaching and learning have been identified as the group that is not interested in using them. These teachers continue to use old teaching methods despite being informed of the affordances of ICTs in teaching and learning. Many older teachers are said to lack ICT skills and their contempt for ICT usage is attributed to assertions that ICT integration is time consuming.

Category 4.2: Lack of principal's role of ICT leadership

The interview findings indicated that although the majority of the teachers encourage the use of ICTs, the implementation is not efficient and effective since most principals did not heed ICT integration in teaching and learning as their responsibility. Consequently the neglect of various ICT leadership tasks result in teachers and some learners following the principal's lead of not embracing ICTs in the teaching and learning environment. Most principals did not grasp what was going on in their schools with regard to ICT infrastructure and ICT use in teaching and learning. The observation of locked and dilapidated computer laboratories was indicative of the fact that the principals were not ICT enthusiasts for teaching and learning and the computers were not utilised. The absence of an ICT timetables was another factor that indicated principals' neglect of their ICT leadership role.

The document analysis reflected on the role of the principal as an ICT leader and states that the GDE's Strategic Objective 2 aims to develop management and leadership at schools for ICT integration, and highlights the importance of equipping schools to manage ICT integration into curriculum delivery (GDE 2007:15). GDE (2011:26) states that the principal is there to manage the eReadiness and the eMaturity of their school and support the progressive increase of ICT usage. Hart and Laher (2015:2) concur and have documented that school leadership plays a big role in encouraging ICT use and the principal's interest or negative attitude in integrating ICTs is the key factor in educational transformation.

The report further shows that it is imperative for school principals and teachers in a school to share their innovations in ICT integration in pedagogical practices. Principals who are enthusiastic about their ICT leadership activities can empower staff members by providing computer literacy lessons, organizing meetings and workshops for teachers with expertise to share ICT knowledge and skills with colleagues and enable ICT competent teachers to share ideas with other teachers (SchoolNet, 2015:8).

Good school governance depends again on a formulated timetable which provides ICT access to all teachers and learners. GDE (2011:24; 2007:7) refers to Management and Usage Guidelines for schools about the manner in which school ICT policies are to be

developed to enable the school leadership to craft its own ICT policy. The tools for implementing policy to achieve ICT educational goals and objectives are also outlined in the ICT education policy.

Category 4.3: Lack of people who support ICT integration

The DBE and GDE's initiatives to implement ICT integration in schools is appreciated however it cannot be the only entity to bear the responsibility of ensuring effective ICT implementation. According to Mnisi (2015:3), the DBE acknowledges the support received thus far but reiterates that the support is not sufficient. In addition, Mnisi (2015:3) notes the President of South Africa, the Gauteng Premier and Gauteng MEC for Education (Engineering News, 2015:2; Sci-Bono, 2014:5) all concur in stating that expertise and resources from the public and private sectors, universities and human resources in NGOs are needed to ensure fruitful integration of ICTs in terms of the NDP.

In the local school environment, school managers play a big role in encouraging use of ICT and are the ones who have to seek professional development of their teachers in terms of ICT integration in teaching and learning. Thus the school principals as ICT leaders in schools are entrusted with the responsibility of inviting experts to share ideas and to develop and equip teachers with pedagogic ICT skills. Competent teachers and those designated as ICT champions are to be given a platform to explain and share their ICT knowledge with other teachers so that they can all be involved in ICT usage (Education SA, 2014:28). GDE (2011:26 and 28) refers to school level ICT committees, ICT coordinators, curriculum specialists and experts outside the school as essential players who have unique roles in ensuring effective integration of ICTs in teaching and learning.

Category 4.4: Funding for ICT integration in teaching and learning

The shortage and lack of funds to deploy ICT in schools constitutes a serious problem (DBE, 2012:8; GDE, 2007:11). Up to this stage, funding for ICT implementation in a school was mainly the responsibility of the DBE and PEDs (Provincial Education Departments) although other methods of procuring ICT equipment were stipulated and accepted (DBE, 2012:8).

School governing bodies, donations by other departments and private donations are some of the stipulated sources for funding and procuring ICT facilities.

The Phakisa ICT document quotes the president calling on the private sector to financially assist government in procuring ICT resources and engage in teacher development activities so as to enable a reduction in capital expenditure by the government (Engineering News, 2014:4).

All analysed documents were relevant for this study in that they dealt with all factors and themes that emerged from the reviewed literature, the empirical study and the observations made during the visits to the school and the administration of the interviews to the participants. The document information was compared with the empirical findings and observation remarks for gaining an in-depth understanding of teachers' perspectives on ICT usage in schools and to help in answering the research questions and to achieve the research aim.

5.8   CONCLUSION

The purpose of this chapter was to present the findings of the empirical research pertaining to teachers' experience of ICT usage in teaching and learning, the observation of the ICT context in the selected schools and the analysis of documents on the phenomenon of eLearning in the schooling system. The first analysis comprised of teachers' and principals' interview transcripts and five main themes with categories emerged. Document analysis was the second method of data analysis and four main themes emerged. The observation analysis was used for triangulation purposes. The relation and the interconnectedness of these themes and their categories are further discussed in the summaries of chapter six. The inferences from the findings of the empirical research and document analysis allow for the conclusions and the recommendations of the study in the final chapter.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1   INTRODUCTION

The previous chapter focused on the discussion of the findings of the empirical study and the literature analysis, and the categories and main themes that emerged from the research data were highlighted. The current chapter provides a holistic overview of the entire study and its purpose is to determine whether the research aims of the study have been achieved. To answer the research questions, the researcher conducted a literature study, empirical research and analysed relevant documents. The Network Society theoretical framework was used as the theory that endorses ICT usage to achieve the goals of a knowledge-based society.

Chapter 6 contains the summary, conclusions and recommendations of the study and suggestions for further research. The first part of Chapter 6 focuses on presenting a summary of the literature review and the empirical study. This is followed by a synthesis of the research findings and a discussion of the conclusions of the study as they relate to the research questions. The recommendations of the study are explained and the chapter ends with a review of the limitations of the study, conclusions and suggestions for further research.

6.2   SUMMARY OF RESEARCH FINDINGS

The findings of the study reveal teachers' and principals' recognition of the importance of ICT use in the enhancement of teaching and learning and the opportunity to assist learners in achieving the skills required in the 21st century knowledge society. The findings also highlight the factors that impede the use of ICTs at schools, poor communications at school and departmental level which result in poor ICT implementation by teachers and principals at school level. The findings are consistent with the theoretical framework as elucidated in Chapter 2, and are supported by the literature reviewed in Chapter 3 which aid answering the research questions. The findings of the literature review, the empirical investigation,

non-participation observation and the document analysis are referred to in subsequent sections.

6.2.1 Summary of findings from literature review

The literature review began by discussing the theoretical framework employed in the study. The theoretical perspective that underpins this study is the Network Society framework theory dealt with in Chapter 2. In this study the theoretical perspective indicates the value of the various learning theories of behaviourism, constructivism and connectivism in an ICT embedded learning environment (see section 2.5). The theoretical framework highlights the necessity for schools, teachers and learners to integrate ICTs into teaching and learning so that 21st century skills can be acquired and a networked society can be realised.

The theory emphasises that knowledge is indispensable for both individuals and communities, and posits that through technology massive knowledge is readily available for anyone, at any place and at any time (Selwyn, 2012:87). This implies that South African teachers and learners in all schools are involved in the knowledge economy as the production of sophisticated workforce is highly prioritised despite the poor ICT contexts experienced in many schools. Therefore, the Network Society paradigm demands that teachers be ICT skilled in order to succeed in teaching 21st century learners who regard ICT as part of their skill set and culture in order to produce the work force required to sustain the knowledge-based society.

The insights gained from the literature study on the theoretical framework provide information which endorses ICT usage in schools and compels teachers to integrate ICTs in their pedagogic practices. This helped the researcher in providing information to answer the main research problem and the first sub-question (see section 1.5). From the categories and themes that emerged from the data, it can be concluded that many South African public schools have a long way to go before they can fully integrate ICTs into teaching and learning. The insufficient number of computers, lack of application software for all curricula subjects, lack of ICT skilled teachers and lack of funds are some of the factors that render the network society theoretical framework impractical in the South African context.

The literature study covered in Chapter 3 helped the researcher to understand the contextual nature of the research problem. The literature highlights the significance of ICT usage in schools as prioritised by education departments all over the world. The cited countries, Scotland, Ghana and South Africa, were compared in terms of planning and implementation of ICT integration in their respective schooling systems. This was done in order to determine how successful schools have handled ICTs in teaching and learning in order to adapt this experience in South African urban schools (see chapter3, sections 3.3.1-3.3.3).

The presence of ICT policy and the effective planning and implementation thereof is of significant importance for the effective use of ICTs in the school environment. It emerges that the unsuccessful integration of ICTs in South African schools can mainly be attributed to the fact that there is no connection between the contents of the ICT in education policy and the practical implementation of ICT in schools as discussed in section 3.3.3.

The cited literature highlighted the competencies and the types of knowledge (TPACK, See section 3.3 and 3.6) required of teachers to be ICT proficient in order to implement ICT for better teaching and learning (Akbulut *et al*., 2011:175).

The reviewed literature further elucidated findings of other studies, illustrating the impact of ICTs on creating a learner-centred pedagogy which allows learners to be actively involved in learning activities, providing opportunities to plan their learning at their own pace and facilitating cooperative learning, all skills required in the 21st century and the network society (UNESCO, 2012:6; Mwalongo, 2011:45; Hennessy *et al*., 2010:49). The power of ICTs in learning can be measured by the decreasing drop-out rate among learners and is thus also an indicator for literacy in African countries (Laaria, 2013b:227).

The literature states that 21st century teachers are compelled to acquire new teaching strategies in order to be able to present challenging and interesting lessons as expected by millennials (Shan Fu, 2013:116). The literature emphasises that ICTs provide teachers with better tools, resources to access and to acquire information and the means to network and

interact with other teachers who share the same interest in personal and professional development.

The principal's role in encouraging ICT implementation at schools is described as crucial in realising the successful use of ICTs in teaching and learning. Literature lists that over and above being a manager and an instructional leader, the principal is in charge of ICT infrastructure and resources, ICT development of teaching staff and is responsible for ensuring ICTs are effectively used in teaching and learning (Laaria, 2013a:1).

The literature review was followed by interviews with the selected teacher and principal participants whose schools are resourced with ICTs. A summary of the empirical study follows in the next paragraph.

6.2.2   Summary of findings from empirical study

The categories and the main themes (see Chapter 5, section 5.5.1 and section 5.5.2) that emerged from the participant interviews describe teachers' and principals' views on ICT usage in teaching and learning in South African urban schools. These themes are listed as follows: inadequate use of ICT infrastructure (See chapter 5, section 5.5.1.1); teachers' proficiency in ICT usage (See chapter 5, section 5.5.1.2); ICT benefits for teaching and learning (see Chapter 5, 5.5.1.3); challenges related to ICT usage (see Chapter 5, section 5.5.1.4) and the enforcement of national and provincial ICT policy.

The participants acknowledged the importance of ICT usage in teaching and learning and added that the integration of new technologies in schools complies with the expectations of the networked knowledge-based society as illustrated in section 2.7.2 of Chapter 2.

The empirical findings relate to factors that promote or deter ICT usage in teaching and learning. The reasons for positive ICT integration are as follows:

- Teachers affirm the use of ICTs in helping them to acquire and share knowledge and the perception was expressed in the following quote:

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> *"ICT is an effective tool, not time consuming, you get information at once in a short space of time".* (Teacher #7)

- Empirical findings indicate that ICTs are viewed as effective pedagogical tools and make things easier for them as expressed by Teacher # 2 in saying:

  > *"Ja, because it* [ICT] *simplifies things and unlike the old methods of teaching, it really simplifies things".* (Teacher #2)

- ICTs are said to enable teachers to change their way of teaching, and as a result, all learners irrespective of their potential, became interested in what is being taught.

  > *"In using computers you have full attention, they concentrate, they see images, use their hands and understand what they what I teach them".*
  > *(Teacher #7)*

- Teachers emphasise that ICTs make lessons more interesting, easier, motivating, more fun and enjoyable for both themselves and the learners who are digitally savvy as referred to in section 3.6 of chapter 3. In support of the assertion Teacher #2 stated:

  > *"Yes they are learning better. It is fun for them when they are busy operating the system. I became happy when they like using the computers"* (Teacher #2)

- With regards to the impact of ICT on learning, the empirical findings indicate learners become more active, more creative and their performance improves as expressed in the following response:

  > *"Learners are stimulated and it enriches their understanding and gets them to participate and become actively involved in the teaching and learning process".* (Teacher #9)

- In addition learners work collaboratively in groups, typical of the characteristics that learners develop through interacting and using ICTs (See sections 2.5.2.5 and 3.3.1). The notion of collaboration was conveyed as follows:

  "Learners work in groups and they help each other". (Teacher #2)

In contrast, poor integration of ICTs in many urban schools is attributable to the following obstacles:

- Inadequate number of computers and tablets, lack of application software, small computer classrooms and an unreliable power supply as indicated by all principals and teachers. One principal stated:

  "The number of our learners in a class is higher than the computers we have including the tablets we have received". (Principal #4)

  Teacher # 7 also mentioned that:

  "Load shedding happens at any time of day and we find ourselves not having electricity during school hours". (Teacher # 7)

- It became evident that while teachers are aware of three types of knowledge they have to master in order to use ICTs effectively, they do not know how to combine technological, pedagogical and content knowledge in their pedagogical practices.

  "I know my subject, I know the methods of teaching and I know a little bit about the computer. My problem is that I do not know to combine these three aspects". (Teacher #9)

- ICT training workshops for teachers are too brief and sporadic hence teachers lack ICT skills and have poor levels of confidence and the lack of future ICT workshops is a big concern among participants. That was evidenced by teacher #4 who stated one hour of training and Teacher #7 and Teacher #9 emphasised the need for more workshops as shown in the response:

"It is a challenge, like I said earlier on, we need to be workshopped more"
(Teacher #9)

It is evident that teachers avoid ICTs to save themselves from the embarrassment of not knowing how to use ICTs in front of their digitally literate learners. Due to technophobia, many teachers are not interested in ICTs while some resist integrating ICT in teaching and learning and continue with their traditional methods of teaching as referred to in section 3.4.

- DBE and GDE authorities as well as the school leadership do not provide the necessary support to ensure that ICTs are effectively integrated in teaching and learning in schools that do have ICT resources. Teachers feel the GDE has let teachers and learners down by not maintaining the infrastructure; not providing funds for ICT issues; and not appointing the personnel to support teachers with ICT implementation.

- It appears that many principals are not aware of their ICT leadership role in school and it surfaced that many principals are not familiar with DBE and GDE policy on ICTs in education. There are no school-based ICT policies to inform the school community on ICT matters in terms of teaching and learning.

- It was found that the use ICTs in the primary schools mainly focuses on teaching learners technological skills rather than using ICT to enhance learning.

Teacher-related factors and school-related factors that are concerns for teachers are depicted in the figure below:
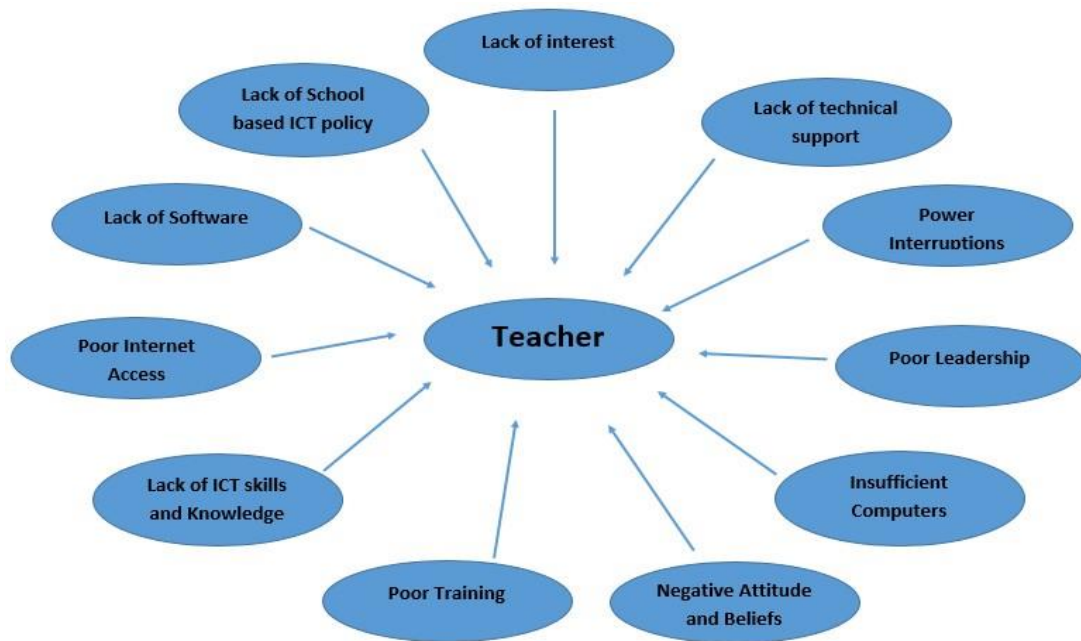
Figure 6.1: Factors that influence ICT integration in teaching and learning

In spite of the challenges highlighted as barriers to technology implementation in schools, there were teachers who held ICTs in high esteem and mentioned the following issues as enablers in the ICT teaching and learning environment: professional development, self-motivation, positive attitude, ICT access, internet connectivity, adequate training, school leadership support and technical support. Teacher-related factors and school-related factors that contribute to effective and efficient ICT integration are illustrated in the Figure 6.2 below:
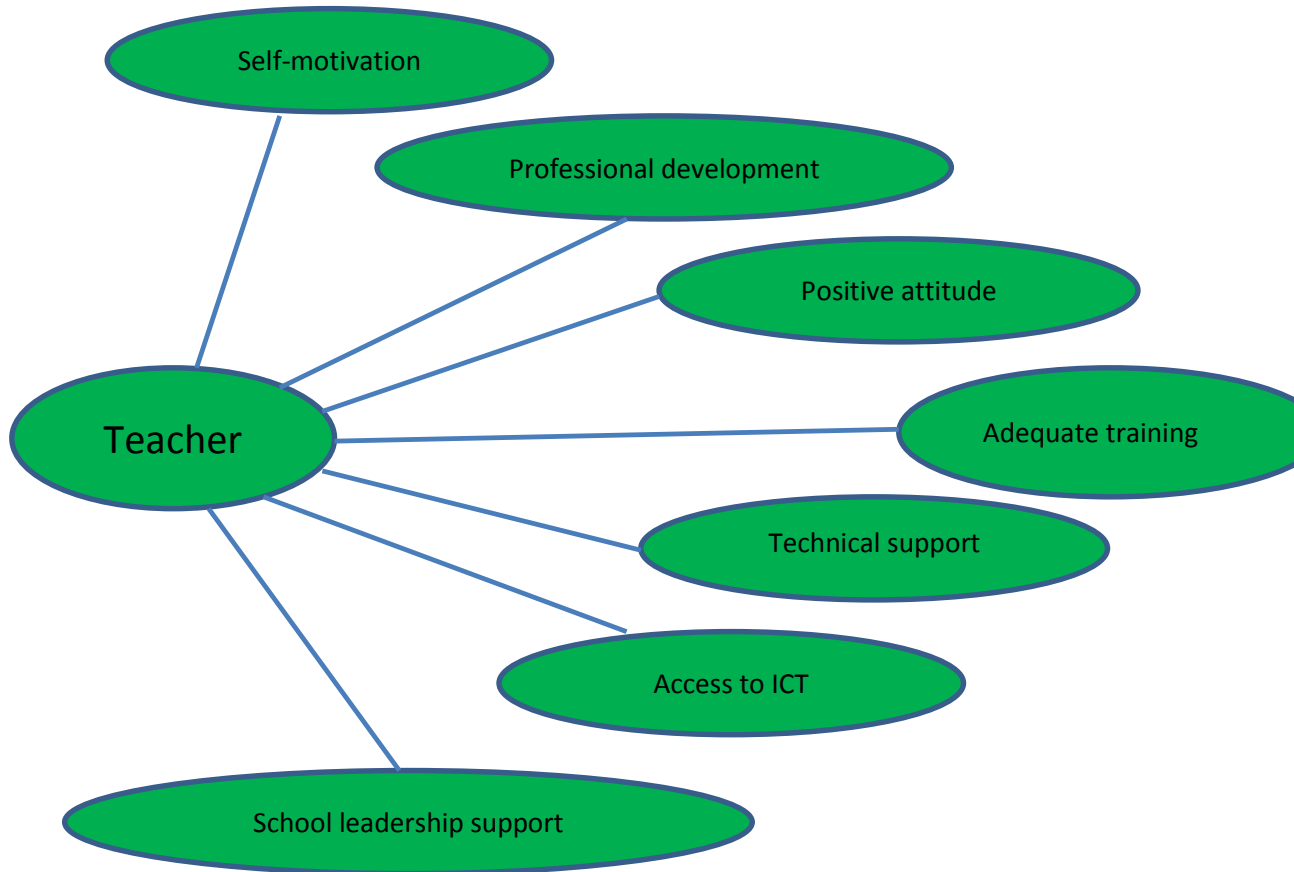
Figure 6.2: Factors promoting ICT usage in teaching and learning

The researcher also engaged in monitoring the ICT contexts of the schools as well as the behaviour of the participants. The findings of this non-participant observation are listed in the next section.

6.2.3   Findings from non-participant observation

The researcher's observations at school and in the computer laboratories, which were carried out with no interaction taking place, yielded the following findings:

6.2.3.1 Physical attributes of the ICT laboratories

The primary schools had computer laboratories with 25 computers and television sets. In one of the primary school the television was missing due to theft. The ceiling, which was destroyed in order to break into the laboratory, was still not fixed due to lack of funds.

In two primary schools the computer labs were not used for teaching and learning but were mostly used by the school leadership and the administrative staff to use the internet to communicate with the District office, and to receive or send official documents.

In one of the primary schools a computer laboratory was built by IBM in the 1980s and now had cracked walls, and was subsequently abandoned on account of safety issues. The computers were left gathering dust in the laboratory. In another primary school where the teacher uses the computers for teaching and learning, learners were found busy with their work. However, the computer laboratory was used as storage for books and other things. The last primary school was built after 1994 and the buildings were of acceptable standard. The computer laboratory was always locked as a security measure as the school was situated in an informal settlement area. The tablets were not seen as they were kept in the strong room.

The high school computer laboratories were well equipped with computers with internet connectivity, white boards, projectors and television sets. The interview data from the principals indicated the ICT infrastructure available in their schools.

> *"We have two computer laboratories, one established by DBE and the other by the Private Sector. GDE supplied us with 40 tablets for teaching Mathematics and English. We have the basics of what is needed by our teachers and learners."*
> (Principal #1)

The observation data indicated that the laboratories were well organised and well utilised by both learners and teachers.

6.2.3.2   Behaviour of Participants

a.   Teachers' behaviour

Most teachers seemed to be interested in the study and found it a platform to voice their challenges. High school teachers and principals were open in expressing their opinions The young high teachers seemed to enjoy working in the ICT laboratory and no longer remain behind with other teachers in the staff room. The teachers seemed to own the laboratories. Other teachers in the school when asked about ICTs in education said they were not responsible for the computer laboratory and knew nothing about what happening in those centres. The researcher found the attitude of these teachers towards ICTs negative, and attributed it to their being older. Their behaviour drew the following responses from their colleagues:

> *"They are saying there is no need, they are exiting the system anyway"*. (Teacher #8)

> *"Some were born before technology; some of them are about to exit to retire, so as a result they are not interested per say in being computer literate so most of them are computer illiterate and are afraid of the computers"*. (Teacher #7)

From the observation and interview data it can be deduced that the majority of older teachers appear to cling to traditional ways of teaching despite the fact that ICTs are regarded as essential tools for enhancing teaching and learning. The researcher's observation also explained why ICTs were so under-utilised in many urban and rural schools.

b.   Principals' behaviour

Observation data exposed the neglect of their ICT responsibilities by the school leadership: principals did not understand the leadership role they have to play in implementing ICT strategies in schools and as a result did not pay adequate attention to the effective use of

ICTs in teaching and learning. Principals confessed that they did not know how to integrate ICTs into classroom practice; they failed to repair broken computers; replace stolen computers; fix dangerous buildings which could endanger the school community; and failed to encourage teachers to develop a culture of accepting ICTs as the modern way to teach today's learners. The researcher found that principals were often naïve in terms of ICT matters and did not grasp their responsibilities as ICT leaders. The primary school principals were also at liberty to express opinions only two teachers had some reservations with regards to certain responses which focused on the school leadership and the Department of Education. The researcher's observation was that principals were very frank as they were nearing their retirement.

c.   Behaviour of learners

Some high and primary school learners literary ran or hurried to the computer laboratory probably to find space. Learners worked in pairs or groups so that all can be involved. All learners showed excitement and seemed to concentrate a lot when working on the computers. Some learners remained in the computer laboratory during break to continue with their work and some learners made a habit of staying in the ICT laboratory for extra 3 hours after school. The interaction of learners was highlighted in the following quotations:

> *"ICT keeps the learners busy. They become interested in the subject and are motivated to know more".* (Teacher #8)

> *"It is fun for them as they operate the system. To operate computers on their own, they are experiencing, they are exploring technology hands-on".* (Teacher #6)

This is supported by literature stating that today's learners are accustomed to using digital tools as indicated in Section 3.6 of Chapter 3.

6.2.3.3   Use of ICTs in teaching and learning

The biographical data revealed that teachers and learners were using computers for Physical Science, Mathematics, Life Sciences, Geography and English in high schools while in some primary schools they were used for Computer Literacy, Natural and Social Sciences. The benefits of ICTs for teachers and learners were highlighted by the following responses:

> *"I teach learners on how to use the equipment, to write on the system or to do research".* (Teacher #4)

> *"I use the internet for research and to get more information regarding my subject".* (Teacher #10)

> *"I allow learners to generate information that they [learners] are able to put onto cloud and access it whenever it is needed*. (Teacher #3)

The ICT benefits are in line with those described in Section 3.4 and 3.6 of Chapter 3.

The final method of collecting data was the document analysis which was done by evaluating different documents containing various factors on ICT integration in teaching and learning. The document analysis summary is dealt with in the next section.

6.2.4   Summary of findings from document analysis

The following is the summary of the main findings emanating from the document analysis:

- GDE is committed to providing ICT infrastructure for integration in order to enhance teaching and learning; however, ICTs supplied to schools are inadequate due to high numbers of learners.
- ICT proficiency level expected of teachers is specified in the policy, and emphasises these skills are of significant importance in terms of ICT implementation to improve teaching and learning. The findings reveal that most

teachers' proficiency is at entry level which indicates there is no conjuncture between theory and practice.

- Training of teachers is characterised as insufficient and has resulted in growing frustration, insecurity and low levels of self-confidence among teachers. Partnerships with NGOs are established to provide the required training for professional development of teachers.

- Affordances of ICTs in teaching and learning include the enhancement of teaching and learning; access to any kind of information required; collaboration with fellows; and establishing a workforce that can develop and sustain the nation's economic growth.

- Findings identify challenges which hamper the implementation of ICTs in schools.

- Negative attitudes, especially on the part of older teachers result in non-use of ICTs in teaching and learning. Poor modeling of ICT leadership by school principals and lack of support for funding ICT integration activities by other stakeholders have also been identified as challenges.

6.3   SYNTHESIS OF RESEARCH FINDINGS

In accordance with the requirements of the Network Society, teachers are required to be lifelong learners and use ICT to enhance teaching skills and their professional development. Literature (Levinsen, 2011:52) states that 21st century teachers must be prepared to undergo training, adapt to new conditions and cope with change and innovation in their main task which is to produce digitally literate and self-directed learners. The findings of the interview data, non-participation observation and documentation are analyses in the subsequent discussion.

During visits to schools the researcher observed cracked walls of an ICT laboratory, unkempt ICT buildings and locked ICT laboratories in some primary schools. These observations gave the researcher the impression that the ICTs were not being used as a tool for teaching and learning as expected in some schools selected for the study. The observations and the data collected from the teachers and principals corroborated these findings. In other words, the

interviews with the participants indicated that some laboratories in their schools were not functional and were always locked as indicated by Teacher #1.

Principal #4 hinted that the computers at her school were unused because only one teacher was computer literate, and she described the unused laboratories as a 'white elephant'. In the reviewed literature Mlitwa and Koranteng (2013:9) concluded that many computers in South African public schools were unused while Moll and Ndlovu (2010:145) mentioned that one of the schools identified for their research study used a fully-fledged computer laboratory as an ordinary classroom. Similar findings were confirmed by Makgato (2012:108) who stated that there is little use of ICTs in teaching and learning due to the fact that many computers in South African urban schools were locked, used as storerooms or for administrative rather than teaching purposes.

Therefore, it can be concluded that the non-use or ineffective utilisation of ICTs in schools is attributable to teachers and principals' failure to execute their duties as managers and instructional leaders in schools as outlined in the ICT guidelines and national ICT policy and following the interviews on ICT policy implementation. The researcher is of the view that teachers and principals were not conversant with the ICT in education policy, which prescribes how ICTs are to be integrated into teaching, as well as the guidelines pertaining to the maintenance of ICT infrastructure in schools. Alternatively, it could be argued that the principal and teachers lack the skill and knowledge to use ICTs.

Inadequate ICT infrastructure emerged as one of the themes of the interviews. Among the issues raised by teachers were inadequate number of computers, lack of software and the problem of power cuts. The observed number of learners in a class made it obvious to the researcher that there were seldom enough computers, particularly in primary schools, for effective use by either individual learners or even pairs of learners. Although the researcher acknowledged that the available number of computers was insufficient, some teachers did manage to apply constructivist principles to their teaching and learning practice, by working with larger groups of learners, but some below-average learners found it difficult to participate effectively.

The interview data is supported by Ndibalema (2014:3) in the case of Tanzanian schools, Laaria (2013 b:16) in terms of Kenyan schools, Buabeng-Andoh (2012:45) as far as ICT use in Ghanaian schools is concerned and Msila (2015:1975) with reference to ICT integration in South African schools. These researchers identified inadequate ICT infrastructure as a major hindrance in ICT integration and it is clearly a challenge shared by a number countries. The findings from the school principals' data (Principal #2, principal #3) also highlight the inadequacy of ICT infrastructure as a factor that inhibits ICT integration in their schools.

As far as the researcher of this study is concerned, lack of adequate ICT infrastructure has a negative impact in that teachers are discouraged from using ICTs in their educational practices. This may explain why some still view traditional teaching methods favourably, even though these suppress learners' creativity, the development of higher-order thinking and problem-solving skills and other qualities deemed significant for the 21st century.

Some factors that encourage or impede effective ICT usage in teaching and learning were disclosed by teachers and principals:

"I haven't seen teachers who are not interested, the only problem that I have noticed is lack of skills. Yes, they all want to be computer literate". (Principal #1)

"Teachers see a computer as a monster, because they are not fully trained". (Principal #2)

These responses indicated the desire to adopt and use ICTs in teaching and learning but also referred to the frustrations of being not able to integrate ICTs to enhance teaching and learning. Lack of teachers' ICT skills, poor teacher training, poor confidence, lack of funds, lack of school ICT policy, failure to appoint ICT coordinators, lack of ICT support by the school leadership and authorities from the DBE Education were identified as issues that prevent successful implementation of ICTs in teaching and education. For example two of the principals complained that in cases where computers were stolen from their schools, it took the DBE a very long time to replace them.

The GoL experience is another case in point: it was reported by Serrao (2009) that the R3bn school computer project intended to get internet-run computer laboratories into every public school in Gauteng, had failed dismally.

Factors such as these listed above appear to be major challenges in other countries as illustrated by findings of the following researchers: Nkula and Krauss (2014:243), Laaria (2013a and 2013b), Mwalongo (2011:36), Chigona *et al*. (2014:2) as discussed in Chapter 3.

The researcher observed the body language of the participants and noted the tension and the frustration that teachers and principals experienced as a result of their inability to fulfill their responsibilities as expected by their employer and the society at large. The researcher concluded that most teacher-related issues arose from the lack of ICT training. These issues which include lack of confidence, poor ICT skills, negative attitude, the reluctance to adopt ICTs in teaching and learning could be resolved by proper teacher development training. The majority of the primary school teachers reported that their experience of training was far from satisfactory:

> *"[Training consisted of] one day, may be it was more or less one hour".*
(Teacher #2)

> *"I am able to use them [computers] but unfortunately so far I have not yet*
> *been trained. So I am only using the knowledge that I have".* (Teacher #9)

High school teachers on the other hand were more satisfied with the training they had received:

> *"At varsity I did computer based courses and I also attend workshops on ICT*
> *matters".* (Teacher #10)

Another significant variable that can help to alleviate the low level of ICT use is the involvement of the parents in the equation because some parents are ICT skilled. These

parents could contribute in the training of teachers to acquire technological skills and in other ways. At one of the schools visited, the School Governing Body (SGB) was very active. The researcher observed a second computer laboratory at a high school and Principal #2 explained it has been donated by a company as a result of fund raising initiatives by the SGB.

The situation was very different at a primary school located in an informal settlement where the principal said the children's parents were predominantly migrants from southern African states or from rural areas in South Africa. According to Principal #4, the majority of the parents were illiterate, some were unemployed, and most had no idea of how to support their children's learning.

It is the researcher's perception that teacher-related factors can be overcome by instituting a training programme that will benefit teachers in all knowledge areas required in terms of ICT use in the educational environment. According to the researcher in this study, the DBE is required to ensure that the training facilitators for public school teachers and principals are reputable individuals or companies that adhere to time frames and achieve set goals.

Successful integration of ICTs by some teachers is influenced by factors such as the need to develop professionally, positive attitude, support and modeling ICT use by the school principal, the aspiration to enable all learners to perform in terms of their potential, employing various teaching methods afforded by ICTs to accommodate learners with different learning styles and learners with intellectual impairment and physical disabilities. Data from the interviews indicate that teachers commend ICT use as images, learning by doing and information search are used to engage learners in their learning process (Teacher #3, Teacher #4 and Teacher#8).

It is evident to the researcher that positive attitudes and the willingness to accept and adapt to change is very important to teachers who want to excel in their duties as teachers and to be relevant to the Network Society and the 21st century. The researchers' observation confirms that the dedication of some teachers in terms of ICT does indeed fulfill teachers

and learners' aspirations and contribute to the achievement of the educational and national objectives according to each learner's personality and potential.

The empirical findings show that teachers agree that they are compelled to integrate ICTs both in terms of educational policy and the requirements of 21st society. In support of this finding, literature (Ghanaian MoE, 2015:10; Mangesi, 2007:3; Livingstone, 2012:11; Tedla, 2012:199; Aktaruzzaman *et al.*, 2011:114; Butcher, 2011:13; Redecker *et al.*, 2010:7; Castells 2007) emphasise that schools as micro-institutions of modern social structure should be in line with the complexity and requirements of the networked, knowledge-based society. As a result teachers must integrate ICTs in teaching and learning in order to produce the sophisticated work force that will benefit the national and global community

The findings indicate that although it is evident that ICTs have penetrated the education sector, the context in South African urban schools makes it very difficult for teachers and learners to join the global world in using ICTs effectively when compared to Scottish schools. Thorough planning and preparation in terms of essentials with regard to ICT usage in education were carefully considered in the Scottish education system hence teaching and learning activities comply with network society stipulations. Poor planning in South Africa has resulted in lack of adequate ICT infrastructure, lack or limited internet access in many urban schools, lack of ICT skills and under-trained teachers. These obstacles render it difficult for South African urban schools to conduct their pedagogic practices in terms of network society theory. The implication is that implementing network theory is still impractical for South African urban and rural schools.

The reviewed literature, the empirical findings and results of document analysis identify similar factors that deter ICT integration in the South African schooling system. The large number of learners, broken computers, unreliable internet connectivity, lack of skills, lack of teacher professional development, teachers' negative attitudes, lack of interest, lack of parental involvement, poor security, lack of confidence, poor ICT technical support and lack of ICT leadership are factors that are mentioned in literature as having a negative impact on the use of ICTs to enhance teaching and learning in schools (Mooketsi and Chigona, 2014:4; Mac Callum *et al.*, 2014:144; Nkula and Krauss, 2014:245; Buabeng-Andoh, 2012:45).

The reviewed literature shows that First World countries such as Scotland (The Highland Council, 2015:7-8; The Edinburgh Council, 2015:2; 3.3.1) that have successfully implemented ICT usage in their schools first gave preference to good pedagogical practice and adequate training of teachers in terms of ICT integration in teaching and learning (The Highland Council, 2015:7-8; Edinburgh Council, 2015:2; 3.3.1). Other researchers (Kannan *et al*., 2012:111; Ndlovu and Lawrence, 2012:20; Doyle and Reading, 2012:1; Mwalongo, 2011:36; Cavas *et al*., 2009:21) concur that teachers are indispensable in effecting educational transformation and it is imperative for them to be well trained in order to achieve what technology can afford when it comes to improved teaching and learning. Literature (Anderson, 2010:106; Redecker *et al*., 2010:9; SAIDE, 2005:20) further state the potential for achieving ICT goals lies in the hands of good, well trained teachers. This is contrary to the empirical finding which indicates that many South African teachers are exposed to ICTs and are expected to use them without the knowledge of how to integrate them into their subject content. A similar state of affairs is experienced by some Finnish teachers who do not have the necessary digital literacy and have no knowledge of how to integrate ICT into their teaching strategies as noted by Sipilä (2014:238).

Findings from reviewed literature, the empirical and observation data indicate that the principal is a key figure in ensuring successful integration of ICTs in a school. The school principal is responsible for ICT resources, and must model ICT usage to the school community and encourage staff members to embrace technology (Laaria, 2013b:1 and 18; Afshari, Ghavifekr, Siraj and Samad, 2012:283; Kannan *et al*., 2012:111). The findings show that the principals' support is important and principals should be knowledgeable about ICTs but it emerges that many do not understand their responsibilities as far as ICTs in teaching and learning are concerned, and are unaware of what is going on in computer laboratories. Lack of school-based ICT policies, ICT vision and missions to regulate and give directives to teachers are examples of principals' ignorance in terms of their ICT leadership role (Afshari *et al*., 2009:81). This is in contrast to principals' ICT roles in the Scottish school system. The responsibilities of the Scottish principals as ICT leaders include the development of plans to take the vision for ICT learning forward, establish digital leadership roles for learners, focus on arrangements of ICT equipment in schools,

budgeting issues, purchasing software and hardware, employing ICT coordinators and the responsibility for developing school-based ICT policies (See section 3.3.1).

6.4   CONCLUSIONS

The main aim of this study was to explore teachers' experience of ICT usage in teaching and learning in South African urban schools (see section 1.6). The empirical study and the document analysis reveal teachers' and principals' perspectives regarding ICT usage in teaching and learning. The conclusions of this study will be stated as answers to the research subsidiary questions.

Sub-research question 1: *What theories endorse ICT use in teaching and learning?*

The first question was answered by referring to the literature review as well as the empirical study. It emerged from the literature review that behaviourism was the first learning theory which was followed by constructivism, and later by connectivism. These learning theories are not mutually exclusive but the uniqueness of each learning theory is determined by the subject matter, the educational goals and the type of ICTs available. The use of drills, educational games and tutorials are significant in enabling learners to memorise and remember content. Although behaviourism is associated with low-level cognitive skills, these educational activities are indispensable in supporting basic knowledge, and are a necessity and prerequisite for developing the higher cognitive skills advocated in the later theories.

Constructivism is a learning theory which allows learners to take charge of their learning and ICTs are used to acquire and construct their own knowledge. Computers, tablets, the internet, smart cellular phones and interactive dictionaries are some of the ICTs used to engage learners prompting them to use higher-order thinking skills in learning activities such as analysing the relevant knowledge to select. In that way, learners are involved in developing their understanding and knowledge (Dema and Moeller, 2012:76). ICTs are significant for learning in that the teacher is only one of the sources of information and through interacting with ICTs, learners discover information, employ cognitive skills in order

to identify what they want to know, think critically and analyse information in order to construct their own knowledge (Dede, 2012:52; Shelly *et al.*, 2010:379).

Connectivism emphasises knowledge construction and the formation of connections for knowledge to flow and be shared by network members. The internet is the technological tool that network members use to engage in dialogue, critique each other, share and distribute knowledge and collaborate with other members (Downes, 2008:1; Siemens, 2004:4).

Various technological tools can be embedded in each of the three learning theories. As illustrated by the reviewed literature (Ertmer and Newby, 2013:69; Dede, 2008:57; Davis, *et al.*, 2008:1). The learning process is impacted by ICTs and consequently all three learning theories endorse ICT integration in teaching and learning in order to facilitate better understanding of the subject matter and for the attainment of the educational goals. (Saavedra and Opfer, 2012:16).

It emerged during the empirical study that the teacher participants used the internet to explain and clarify subjects so that learners would have a better understanding of the learning material (Teacher #4 and Teacher #7). This is in line with the behaviouristic paradigm which emphasises the transfer of information from the tool to the learners.

The use of the internet to get information, to identify and to analyse information and to use the internet to distribute, share and to collaborate, online participation and use of social media touched on by high school teachers, attest to the relevance of ICT application in constructivism and connectivism.

Sub-research question 2: *What is the ICT proficiency level of teachers in ICT usage in teaching and learning?*

Literature indicated that teachers should be at adoption, adaptation or appropriation proficiency levels in order to integrate ICTs with confidence (GDE, 2011:16; DBE, 2007:7). However many teachers are said to be at entry-level proficiency due to lack of TPAC

knowledge (Sci-Bono, 2015:5). Non-use of ICTs in schools with ICT infrastructure is due to poor ICT skills among teachers, with a few at entry level while the majority are digitally illiterate (GDE, 2007:11).

The answer to this question is that many teachers are not at the proficiency level deemed appropriate to enable them to use ICTs with ease. This is confirmed by lack of ICT skill among the majority of primary school teachers as indicated by the Teacher #9's response which expressed the inability to use the computer programs:

> "*I like to use the computers but I do not know how to combine that with the methods of teaching*". (Teacher #9)

Teacher #7 focused on the fear of being made to feel inadequate by their techno-literate learners.

The interview data revealed that teachers have pedagogical and content knowledge, however, the majority of the teachers lack technological knowledge. Teachers are either struggling or do not know how to use ICTs in their teaching. In terms of Koehler and Mishra's (2009) TPACK Framework as explained in Chapter 3, emphasis is on the interaction between and among the three knowledge areas to produce the knowledge needed to successfully and effectively integrate ICTs into pedagogical practices.

Teachers therefore are expected to acquire an understanding of the representation of concepts using technologies, pedagogical techniques that use technologies in constructive ways to teach the content and how technology can help to redress some challenges that learners encounter (Koehler and Mishra, 2009:66). The non-participant observation data of the majority of teachers not engaging in ICT use in teaching and learning indicated that there was a lack in some of the knowledge areas needed to facilitate effective ICT integration in teaching and learning.

Consequently, it can be concluded that the majority of primary school teachers are at entry-level proficiency whereas the high school teachers expressed confidence in using ICTs

for teaching and learning. In terms of the ICT proficiency levels as described by DBE (2007:7), high school teachers are at adoption and adaptation proficiency level depending on the training received by individual teachers. The biographical information of Teacher #1 indicated a high qualification in Computer-Based Education but the computer laboratory is not functional as it is always locked. Clearly the teacher was placed at the wrong institution and her expertise and specialisation are not being used in the appropriate manner.

 From the researcher's observation, this is not an isolated case and teachers are often employed and allocated to subjects they are not well qualified to teach. The under-performance of learners in many public schools in urban and rural areas could be attributed to teachers who are not adequately qualified in the subjects they teach. The researcher is of the opinion that it is incumbent upon DBE to ensure teachers are appointed to appropriate posts.

Sub-research question 3: What are the factors that impede or promote ICT use in an educational environment?

The reviewed literature indicates that the effective implementation of ICTs is hampered by factors which are classified as teacher-related and school-related characteristics. Teacher beliefs, negative attitudes, confidence, religion, age, gender, resistance, educational level and personal experience are some of the variables that prevent teachers from integrating ICTs in their activities (Ahmad, 2011:2; Afshari *et al*., 2009:79). The school-related factors are inadequate ICT infrastructure, lack of time, lack of access to ICT resources, poor training, inappropriate organisation, technical problems, lack of vision and mission about the significance of ICT in teaching and learning and poor leadership (Afshari *et al*., 2009:81).

The empirical study revealed factors which can be classified as teacher-related characteristics such as confidence, age, gender, negative attitude, lack of interest and lack of skills emerged as the factors that influenced successful ICT usage in schools. The school-related factors which emerged during the empirical study are similar to those identified by Afshari *et al*. (2009:81) and include an insufficient number of computers, large numbers of

learners, lack of internet access, poor power supply, lack of school-based ICT policies, lack of ICT vision and lack of ICT leadership.

However, there are factors that encourage teacher to adopt and integrate ICTs in their teaching. These factors include professional development, self-motivation, positive attitude, access to ICT infrastructure, internet connectivity, technical and school leadership support. These are the traits that must be reinforced and embedded so that all teachers can use ICTs effectively and efficiently as expected.

Sub-research question 4: *What recommendations can be made to improve teachers' ICT proficiency?*

This study found that there were obstacles to ICT usage among teachers and principals, and made a number of suggestions that, if implemented, could increase teachers' proficiency in ICT usage. Prior to citing these recommendations, it is imperative to reflect on whether the main research question that prompted this study, as well as the subsidiary research questions, had been answered. A discussion of these follows.

This study sought to answer the main research question stated as:

What are teachers' experiences of the use of ICTs in teaching and learning?

This research question was further operationalised by four subsidiary questions which are:

1.   What theories endorse ICT use in teaching and learning?
2.   What is the ICT proficiency level of teachers in ICT usage in teaching and learning?
3.   What are the factors that impede or promote ICT use in an educational environment?
4.   What recommendations can be made to improve teachers' ICT proficiency?

The investigation was carried out using a qualitative approach and the researcher found that the reviewed literature and the collected data did indeed provide answers to the main and

subsidiary research questions. The coding and the categorisation of data enabled an analysis which offered insights into teachers' experiences of ICT usage in teaching and learning. A summary of the analysis and findings of teachers' experiences of ICT usage in urban schools is presented in the next section.

Teachers' positive views on ICT usage in teaching and learning

The analysis of the collected data provides evidence of the benefits of using ICTs in an educational environment. Data shows that some teachers welcome ICT integration for transforming teaching strategies and the learning process. The collected data also evidences the pedagogical benefits with regard to teachers' engagement and learners' participation and motivation. The significance of ICTs includes encouraging constructive learning so that learners develop reasoning, creativity, problem-solving skills and information accessing and evaluation skills. Another benefit of ICTs is the potential to foster a learner-centred pedagogy which emphasises the teacher's role as a facilitator.

Teachers' negative views on ICT usage in teaching and learning

Despite the findings on the benefits of ICTs in the classroom, other factors highlight the challenges and negative experiences which prevent teachers from using ICTs efficiently in the classroom. Data on teachers' poor ICT skills answers sub-question 2 stated as: *What is the ICT proficiency level of teachers in ICT usage in teaching and learning?* This finding is supported by the reviewed literature (section 3.6) and principals' dereliction of their ICT leadership roles (section 3.5), while the inadequacy of ICT infrastructure and lack of support from the education authorities were highlighted as major hindrances to ICT integration (section 6.3).

Reflection on the theoretical framework

In addition to understanding the benefits and challenges of ICTs in terms of teachers' views of the phenomenon, the Network Society Theoretical framework provides a deeper understanding of the importance of ICT integration in schools in developed and developing

countries. The theoretical framework points to access to ICT infrastructure and TPACK skills which are essential for all teachers if they are to be effective in any given instructional milieu. The reflection on the theoretical framework provides the answer to the sub-question 1: What theories endorse ICT use in teaching and learning?, and concludes that all the reviewed learning theories support ICT use in teaching and learning activities (See Chapter 2). While the network society theory has global implications on ICT implementation, it is accepted by the South African government. Nevertheless, the researcher is of the opinion that this theory is not applicable to the whole South African society because ICTs are only available to a certain section of the society. The schools in poor rural areas are excluded from participating in the network society due to insufficient or lack of ICT resources and skills. It is imperative that the South African government and the DBE prioritise provision of the essential ICT tools and appropriate ICT training programs so that principals, teachers and learners could be on board of the ICT ship which qualifies schools to produce the required caliber of learners and members of the network society.

The next section comprises of the suggested recommendations that could lead to effective ICT utilisation in teaching and learning.

6.5   RECOMMENDATIONS OF THE STUDY

This study discovered that many teachers are afraid of using ICTs in their teaching and there are serious problems which have to be resolved in order for teachers and principals to accept and adopt ICT usage in schools. The interventions require collaboration of all stakeholders so that the ICT context in urban schools can improve. The recommendations will be discussed next.

6.5.1   Recommendations for the Department of Basic Education

Policy is important in the regulation of activities and to give the directive to practitioners. The content of DBE and GDE ICT in Education policies is at odds with what is actually happening in schools. ICT policy must take into consideration the socio-economic status at some South African public schools and should be revised in accordance with the true

context of the South African background rather than being crafted in terms of the First World countries which have ICT skilled teachers and the means to successfully utilise ICTs in teaching and learning.

Based on the empirical findings and literature analysis that indicate many teachers lacked TPAC knowledge and are incompetent when it comes to integrating ICTs in their teaching, it is imperative for GDE to conduct intensive ICT training workshops and institute continual training to ensure that all teachers are on board in terms of integrating ICTs into their pedagogical activities. It is suggested that the TPAC model developed by Koehler and Mishra (2009:62) be used in the professional development of teachers to enable them acquire and combine the three knowledge types.

Teachers must start by acquiring **technological knowledge (TK) which means that they must know about** digital technology and the software and how to use them. The learned technological knowledge must be used with the **pedagogical knowledge (PK)** which is the second type of knowledge. The pedagogical knowledge is the teachers' knowledge of the pedagogical strategies that they use in teaching their subjects. This is the knowledge which teachers received during the teacher training. **Content knowledge (CK)** is the third type of knowledge and refers to knowledge of the subject matter which teachers specialise in.

The training must enable teachers to combine technological and pedagogical knowledge to form **technological pedagogical knowledge (TPK).** The intention is to capacitate teachers to know what technologies to use with certain pedagogical strategies. The training must enable teachers to develop **technological content knowledge (TCK)**. Finally the mastery of the three types of knowledge will connect **technological pedagogical content knowledge (TPACK)** which will enable teachers to use with the necessary technologies and pedagogical skills to teach subject matter effectively. The three types of knowledge and their intersection are presented in the diagram below.
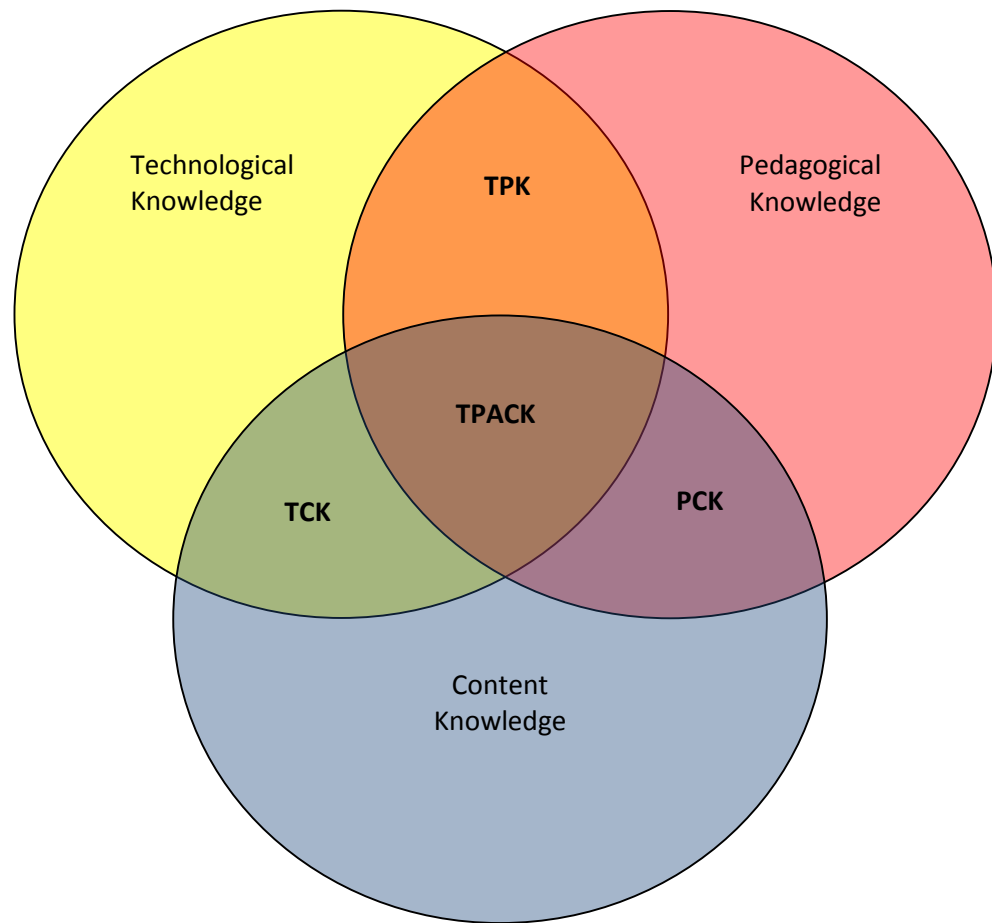
Figure 6.3: Representation of TPACK aspects (Koehler and Mishra, 2009:63).

It is suggested that the training of teachers for the acquisition of technological, pedagogical and content knowledge be based on the TPACK Framework and the CRAR3FS2 training package as expounded by Du Plessis and Webb (2010). The CRAR3FS2 package emphasises that training be conducted while the service providers consider the following characteristics: Care, Relate, Assess, Reflect, Read, Re-Plan Feedback, Share and Support. The **CRAR3FS2** prescribes that the service providers and trainers be familiar with the South African school contexts and the type of a teacher found in South African urban schools.

With reference to the researcher findings in this study and the need to address the inadequate training issue, ICT trainers need to establish an environment that is conducive to the learning context and ensures that teachers are well cared for and are assured that they will achieve their TPACK goal. This will be made possible with a cordial relationship between the trainer and the teachers undergoing training. Trainers are to make teachers

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reflect on their **CK** and **PK** and relate to TK to yield **TCK** and **TPK** thereby assessing their specific needs for **TK**. In so doing they reflect on the knowledge base to bridge the gap by reading, writing on their journals, re-planning on how to integrate ICTs, providing feedback to ensure if teachers are on the right track and to clarify some issues encountered in the training. Teachers share the best practices and support one another while the authorities, school leadership and ICT committees at school level continue giving the necessary support.

By incorporating **CRAR3FS2** with the knowledge and experience that teachers already possess, this training program may accomplish **TPACK** goal. The envisioned training program is depicted in the figure below.
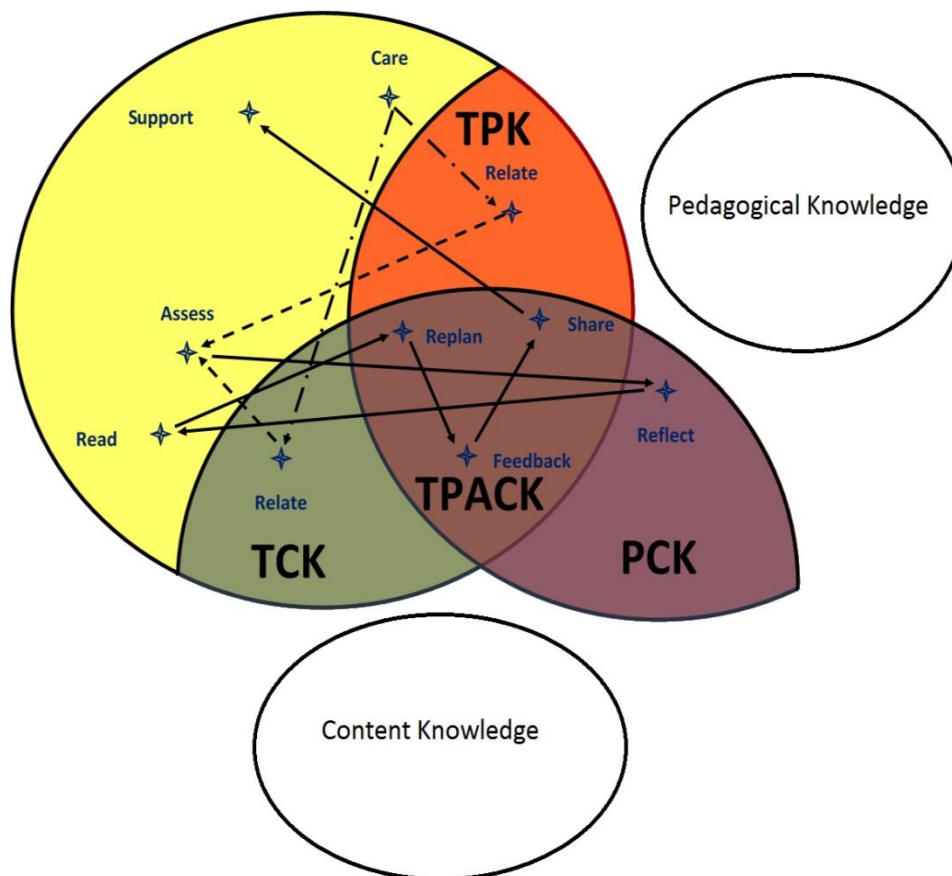
Figure 6.4: CRAR3FS2 to achieve TPACK

Regular training and follow-up workshops to ensure that teachers are on track with regard to ICT integration should be conducted on an on-going basis.

The DBE and GDE should educate school principals on their roles as ICT leaders. The training should encompass the reasons for using ICTs in teaching and learning so that they can be familiar with their responsibilities. In addition to that the principals must know the obstacles to ICT integration at schools and be informed on the appropriate strategies they can apply to address these challenges.

Lastly, it is suggested that GDE, the school and parents collaborate in making attempts to provide adequate ICT infrastructure so that each and every learner and teachers can integrate ICTs without leaving anyone behind. Parents should be prepared to make financial contributions.

6.5.2   Recommendations for school leadership

GDE and school leadership should work together in ensuring that ICT technical staff is employed to solve and clarify technological issues, to help teachers with the new technological developments and build teacher confidence.

Lack of school-based ICT policy and plans have resulted in the non-use of available ICT facilities. The recommendation in this regard is to develop an understandable policy and a clear implementation plan that lays out the school's objectives for integrating ICTs and the reasons underlying these objectives. Principals must work with teachers in formulating the school ICT policy and goals so that the implementation of the policy can be binding on all staff members.

It is further recommended that principals establish ICT committees and choose a teacher who will oversee all matters pertaining to ICT usage at school and a leader who will encourage all teachers to use ICTs. The school's ICT leader should meet with ICT leaders from the neighbouring schools to deliberate on how ICTs can be integrated into various subjects, and help each other that so that all teachers can fulfill ICT expectations.

Principals are advised to engage parents and learners in efforts to supplement ICT infrastructure availed by the GDE and the private sector. This is due to the fact that it cannot

be the responsibility of GDE alone. All stakeholders must take part in securing ICTs so that all learners can be catered for.

Lack of time dedicated to ICTs was identified as one of the major issues. It is suggested principals introduce technology days, one day every two weeks, and schedule time for discussion among teachers on matters relating to ICT integration. This will give teachers the opportunity for updates and to help those teachers who encounter challenges.

It is important that principals are creative in implementing their responsibilities as ICT leaders. They must be aware of the strategies that promote ICT usage and know how to combat the conditions that hamper ICT usage in teaching and learning.

6.5.3   Recommendations for teachers

Teachers need to be informed about the significance of ICTs in teaching 21st century learners who are currently in their classrooms and how these learners want to be taught.

Today's learners are knowledgeable about technology, and teachers must allow themselves to be peer-tutored by their learners about how to use ICTs effectively. Learning from their learners will contribute to building teachers' ICT skills and confidence. Lastly, teaching teachers who are boomers or less innovative, replicates what teachers do in their jobs and this experience may develop cordial relationships between learners and teachers.

Teachers are encouraged to participate in communities of learning to help one another with pedagogical issues, share knowledge and support one another on matters pertaining to ICT usage in their various schools. This could have a positive impact on teachers' beliefs and attitudes towards ICT integration and they may be motivated to use technology in similar ways.

6.6   SUGGESTIONS FOR FURTHER RESEARCH

This study focused exclusively on teachers' perspectives on ICT use in teaching and learning and there is a need for an in-depth investigation of ICT usage by looking at the issues that arise as a result of ICT application in teaching and learning within the South African context. Further exploration of ICT use should include larger samples from various urban schools within Gauteng. Exploring these aspects in future research initiatives will help maximise the use of ICT by all teachers in all subjects, ensuring the production of learners who are efficient ICT users and the realisation of a knowledge society which is one of the national goals in terms of the introduction of ICTs in schools.

It is recommended that further research focus on South African principals' ICT leadership since the current research revealed that most principals are unaware of their responsibilities as ICT leaders at their schools. Other research findings of this study indicated the disjuncture between policy and its implementation in the classroom setting.

6.7   LIMITATIONS OF THE RESEARCH STUDY

Noble and Smith (2015:1) point out that the big challenge and criticism of qualitative research is that qualitative research depends on the researcher and the findings are "*merely a collection of personal opinions subject to researcher bias".* By virtue of this researcher's views and perspective being a deciding factor in the research findings, the implication thereof is that all qualitative research has limitations. In this study the following four limitations are evident:

6.7.1   Researcher's subjectivity

The first limitation of this study is the researcher's selection of the teachers and school principals who participated in the study (see Section 1.9). The researcher's discretion was used when selecting the research participants and those selected had the necessary experience and information to answer the research questions.

6.7.2 The sample size

The research population, five primary school teachers, five high school teachers and five school principals consisting of three from primary school and two from high school, it is a relatively small sample when it comes to ascertaining problems that are common to all teachers who are integrating ICTs in teaching and learning.

6.7.3 Insecurity issues

Another limitation was designated as insecurity issues: feelings of insecurity when speaking out were experienced by some of the participants who asked not to be recorded when answering some interview questions. When this happened, the researcher recorded their answers in a journal.

6.7.4 Time allocated for data collection

Lastly, the researcher spent three months conducting interviews and this was held to be too brief a period of time as the information obtained was considered to be a fraction of the many issues experienced in schools regarding the use of ICTs. In addition, scheduled interview times sometimes had to be reduced because participants had other commitments, although member checking enabled the researcher to gather much of the information sought.

Despite the limitations as listed above, the researcher believes that this study will help to change the mindset of many South African teachers who disregard the importance of ICTs in teaching and learning whilst ICTs are a necessity for the 21st century schooling of a networked, knowledge-based society. The suggested recommendation of combining TPACK and CRAR3FS2 as the training program for South African teachers with regard to ICT usage in their pedagogical activities emanates from various participants' reiteration of lack of TPACK which is a major factor for ineffective use of ICTs in teaching. The combination of the two models may help disillusioned teachers to see the value ICT add in teaching and learning.

The end result could be the total acceptance and integration of these models for improved teaching and learning and to meet the requirements of the 21st century teacher.

A thorough training program for principals on ICT leadership role is of utmost importance so that school leaders can assume the attributes of ICT leadership which include risk taking, demonstrating to the school the need to change by integrating technology and provide opportune time for professional development of teachers to trial new approaches which involve ICTs in their teaching techniques. Leading the school by modeling ICT use to staff and learners and finding creative ways to mobilise, encourage and enforce ICT culture in a school.

It is hoped that this study will encourage the South African education departments, school leaders, teachers, parents and civil society to collaborate in ensuring that ICTs integration becomes a norm in the South African schooling system. The idea is to realise the country's vision of an ICT capable workforce and knowledgeable citizens who will compete in a global arena.

6.8   CONCLUSION

All teachers are obliged to use ICTs in teaching and learning in the networked, knowledge-based society regardless of their geographical location, age, gender and socio-economic background. The nature of the 21st century learners demands that teachers integrate ICTs into pedagogic activities in order to prepare them for 21st century citizenry and the future workforce. The behaviouristic, constructivist and connectivist learning theories and the network society theoretical framework provide space for embedding ICTs for teaching and learning. A thorough study of the three paradigms revealed that no learning theory is better than the others in terms of including ICTs for teaching and learning. The reviewed literature endorses the use of ICTs in education by various nations of the world to the benefit of both teachers and learners. The effective and creative implementation of ICTs creates better opportunities for teaching which are deemed important in this new era. In spite of the positive side associated with ICT integration in teaching and learning, literature documents conditions that hinder full utilisation of ICTs by teachers.

In line with the reviewed literature, the study reveals the conditions that hinder the successful implementation of technology in teaching and learning in South African urban schools. Factors were classified as teacher-level characteristics and school-level characteristics. Lack of connection between ICT policy and practice in schools surfaced in the document analysis, with many schools not having an ICT policy document. To improve current usage of ICT in schools, a number of recommendations, based on the findings of this study, are directed to DBE, school principals in their role as ICT leaders and teachers as pedagogic practitioners. The suggestions could be valuable to teachers and principals in South Africa at large.

In conclusion, the findings from the study firstly highlighted a myriad of reasons that underlie the ineffective use of ICTs in South African urban schools and how this has influenced the way ICTs are perceived and used by urban school teachers who integrate ICTs in their teaching. Figure 6.1 and Figure 6.2 depict factors put forward by teachers as hindrances or enablers to ICT integration in their teaching. One major concern that was flagged as the underlying cause for ineffective use of ICTs at schools was the inadequate training of teachers in integrating their content knowledge and pedagogical knowledge and lack of training of the principals on how to execute their ICT leadership roles.

Therefore, this study suggests a training program that may meet teachers' specific needs and help teachers develop technological and pedagogical knowledge to enable them to integrate ICTs in their teaching with ease. The training programme would consist of the combination of the TPACK model and the CRAR3FS2 (Figure 6.3) which is seen as contextually appropriate for South African teachers who are not at entry level with regard to ICT adoption and use in schools.

Secondly the findings identified the obstacles to principals carrying out their responsibilities and the study suggested solutions which they could adopt in order to realise their responsibilities as instructional and ICT leaders in the teaching and learning environment.

Finally the findings pertaining to the DBE and the ICT policy issues highlight the various ways of amending and adjusting some practices so that the national ICT objectives can be

achieved as well as ensuring that all principals endorse ICT integration for better teaching and learning and teachers are empowered to teach as expected of the 21st century teacher in the networked and information-based society. This information might be informative to all education stakeholders.

BIBLIOGRAPHY

Abdullah, N. A. W., De Witt, D. and Alias, N. 2013. School improvement efforts and challenges: A case study of a principal utilizing information Communication Technology. *Procedia: Social and Behavioral Sciences*, 103.

Adamson, C. 2013. ICT in the classroom: Namibian teachers share their experience. Accessed on 04/06/2013 from http://www.elearning-africa.com /eLA_Newsportal/ict-in-the-classroom-Namibian teachers.

Afshari, M., Bakar, K. A. Luan, W.S., Samah, B.A and Fooi, F.S. S. 2009. Factors affecting teachers' use of Information and Communication Technology. *International Journal of Instruction*, 2(1), 77-101.

Afshari, M., Bakar, K. A. Luan, W.S. and Siraj, S. 2012. Factors affecting the transformational leadership role of principals in implementing ICT in schools. *Turkish Online Journal of Educational Technology*, 11 (4), 164-176.

Afshari, M., Ghavife*kr,* S., Siraj, S. and Samad, R.S. 2012. Transformational Leadership role of Principal in implementing Informational and Communication Technologies in Schools. *Life Science Journal*, 9 (1), 281-284.

Aguti, J. N. 2016. ICT Integration and Digital Competencies – a must for 21st century teachers. Accessed on 08/03/2016 from http://dspace.col.org

Ahmad, T. B. T. 2011. Between School Factors and Teacher Factors: What Inhibits Malaysian Science Teachers from using ICT? *Malaysian Online Journal of Educational Technology,* 2 (1), 1-10.

AlDahdouh, A., Osório. A. J. and Caires, S. 2015. Understanding knowledge network, learning and connectivism. *International Journal of Instructional Technology and Distance Learning*, 12 (10):3-21.

Akbulut, Y., Odabasi, H.F. and Kuzu, A. 2011. Perceptions of pre-service teachers regarding the integration of Information and Communication technologies in Turkish education faculties. *Turkish Online Journal of Educational Technology*, 10 (3), 175-184.

Akpan, J. P. and Beard, L.A. 2016. Using Constructivist Teaching Strategies to Enhance Academic Outcomes of Students with Special Needs. *Universal Journal of Educational Research*, 4(2): 392-398.

Aktaruzzaman, M. D., Shamim, R.H. and Clement, C.K. 2011. Trends and Issues to integrate ICT in Teaching Learning for the future world of Education. *International Journal of Engineering and Technology*, 11(3): 114-119.

Alfreds, D. 2015 The City of Tshwane's free WI-FI programme hit a milestone of one million unique devices on Wednesday. Accessed on 29/10/2015 from http://www.timeslive.co.za

Allahyar, N. and Nazari, A. 2012. Potentiality of Vygotsky's sociocultural theory in exploring the role of teacher perceptions, expectations and interaction strategies. *WoPaLP*, 6: 79 – 88.

Allmark, P., Boote, J., Chambers, E., Clarke, A., McDonnell, A, Thompson, A. and Tod, A. M. 2009. *Research Ethics review,* 5 (2): 48-54.

Al Sharija, M. and Qablan, A. 2012 Leadership strategies for Integration of ICT in Kuwait Schools: Perceptions, Practices and Possibilities. *Public Policy and Administrations Research*, 2 (6): 18-28.

Altuna, J. and Lareki, A. 2015. Analysis of the Use of Digital Technologies in Schools That Implement Different Learning Theories. *Journal of Educational Computing Research*, 0 (0) 1–23.

American Association of Colleges for Teacher Education (AACTE). 2010. *21st Century knowledge and skills in educator preparation*. Accessed on 14/02/2013 from http://www.p21.org

Anderson, J. 2010. *ICT Transforming Education: A Regional Guide.* Bangkok: UNESCO.

Aslan, A. and Zhu, C. 2016. Influencing factors and integration of ICT into teaching practices of pre-service and starting teachers. *International Journal of Research in Education and Science, 2*(2), 359-370.

Babbie, E. 2010. *The Practice of Social Research.* Wadsworth, Belmont

Balanskat, A. 2007. Study of the impact of technology in primary schools (STEPS). Accessed on 27/09/2011 from http://eacea.ec.europa.eu/IIp

Bartolomé, A. and Steffens, K. 2015. Are MOOCs Promising Learning Environments? *Media Education Research Journal*, 44 (XXII): 91- 99.

Begg, A. 2015. Constructivism: an overview and some implications. Accessed on 29/09/2016 from http://researchspace.auckland. ac.nz

Bell, F. 2010. Network theories for technology-enabled learning and social change: Connectivism and actor Network theory Connectivism: Accessed on 29/09/2014 from http://www. lancaster.ac.uk

Bell, F. 2011. Connectivism: Its place in theory–informed research and Innovation in technology-enabled Learning. *The international Review of Research in Open and Distance Learning*, 12 (3): 98 -118.

Berry, M. 2008. Power/Knowledge in the information Age: The epistemological Implications of ICTs and Education for All. Accessed on 17/03/2010 from http//web.uvic.ca

Bingimlas, K. A. 2009. Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science and Technology*, 5 (3), 235-245.

Bladergroen, M., Chigona, W., Bytheway, A., Cox, S. Dumas, C. and van Zyl, I. 2012. Educator discourses on ICT in education: A critical analysis. *International Journal of Education and Development using Information and Communication Technology,* 8 (2): 107-119.

Bowen, G. A. 2009. Document Analysis as a Qualitative Research Method. *Qualitative Research Journal,* 9 (2): 27-40.

Boyinbode, O. K. and Akintola, K.G. 2009. Effecting e-Learning with U-Learning Technology in Nigerian Education System. *Pacific Journal of Science and Technology*, 10 (1): 204-210.

Bradley, J. 1993. Methodological issues and practices in qualitative research. *Library Quartely*, 63 (4): 431-449.

Brown, T. H. 2006. *Beyond* constructivism: Navigationism in the knowledge era. *On the Horizon,* 14 (3): 108 -120.

Buabeng-Andoh, C. 2012. An Exploration of Teachers' Skills, Perceptions and Practices of ICT in Teaching and Learning in the Ghanaian Second-Cycle Schools. *Contemporary Educational Technology*, 3 (1), 36-49.

Butcher, N. 2011. ICT, Education, development and the Knowledge Society. Accessed on 03/11/2015 from http://creativecommons.org

Castells, M. 1999. The Information Age: Economy, Society and Culture. *Journal of Planning, Education and Research,* 19: 211-213.

Castells, M. 2000. The Rise of the Network Society: The information Age: Economy, Society and Culture. London: Wiley.

Castells, M. 2007. Communication, Power and Counter-power in the Network Society. *International Journal of Communication,* 1: 238-266.

Castells, M. and Cardoso, G. 2005. The Network Society: From knowledge to policy. Accessed on 12/09/2011 from http://www.umass.edu.digitalcenter/research/pdfs.

Cavas, B., Cavas, P, Karaoglan, B. and Kisla, *T. 2009.* A study on Science Teachers' attitude towards Information and Communication Technologies in Education. *Turkish Online Journal of Educational Technology,* 8 (2): 20-32.

Chan, D. 2006. The role of ICT in a Constructivist Approach to the Teaching of Thinking Skills. Accessed on 10/07/2011 from http://static1.1.sqspcdn.com

Chigona, A. and Chigona, W. 2010. An investigation of factors affecting the use of ICT for teaching in the Western Cape schools. Accessed on 04/02/2013 from http://aisel.aisnet .org

Chigona, A., Chigona, W. and Davids, Z. 2014. Educators' motivation on integration of ICTs into pedagogy: case of disadvantaged areas. Accessed on 28/09/2016 from http://www.sajournalofeducation.co.za

Collie, P., Lewis, L. and Méro, P. 2011. A guide to ICT in the UK education system. Accessed on 08/08/2011 from http://www.educationimpact.net.

Cox, M., Webb, M. Abbott, C, Blakeley, B., Beauchamp, T. and Rhodes, V. 2003. ICT and Pedagogy: A review of research literature. Accessed on 02/10/2008 from http://www.becta.org.uk/research.

Creswell, J. W. 2007. Qualitative Inquiry and Research design: Choosing among five approaches. Second edition. London: SAGE Publications.

Dae, J. H., Yang, H. and Hyeonjin, K. 2010. E-Learning in the Republic of Korea. Paris: UNESCO.

Davis, C., Edmunds, E. and Kelly-Bateman, V. 2008. Connectivism. Accessed on 25/05/2012 from http://epltt.coe.uga.edu/index.php

De Clerq, F. 2013. Professionalism in South African Education: The challenges of developing teacher professional knowledge, practice, identity and voice. Accessed on 01/12/2015 from http://joe.ukzn.ac.za

Dede, C. 2008. Theoretical perspectives influencing the use of information technology in teaching and learning. Accessed on 27/10/2011 from www.msedtechsandbox.com/hybrid/wp-content.

Dema, O. and Moeller, A.J. 2012. Teaching culture in the 21st century language classroom. Retrieved from http://digitalcommons.unl.edu/teachlearnfacpub

Department of Basic Education. 2004. White paper on e-Education: Transforming Learning and Teaching through Information and Communication Technologies. Pretoria: Government Printers.

Department of Basic Education. 2007. Guidelines for Teacher Training and Professional Development in ICT. Pretoria: Government Printers.

Department of Basic Education. 2011. Curriculum and Assessment Policy Statement (CAPS): Natural Sciences and Technology. Pretoria: Government Printing Works.

Department of Basic Education. 2012. Guidelines for schools: ICT Hardware Specifications. Pretoria: Government Printers.

Department of Basic Education. 2015. NECT Annual Report 2014/15. Accessed on 18/01/2016 from http://www.education.gov.za

De Vos, A. S., Strydom, H., Fouché and Delport, C. S. L. 2011. Research at Grass roots for the social sciences and human service professions. Pretoria: Van Schaik.

Downes, S. 2008. Connectivism and its critics: What connectivism is not. Accessed on 10/04/2009 from http://www.downes.ca/post/53657.

Doyle, H. and Reading, C. 2012. Building teacher educator TPACK: Developing leaders as a catalyst for change in ICT Education. Accessed on 12/06/2013 from http://www.une.edu.au/education/ttf/TTFUNEScienceTeacherEducatorStory.pdf

Draper, K. 2010. Understanding science teachers' use and integration of ICT in a developing country context. DEd Dissertation. University of Pretoria.

Duffy, T. M. and Cunningham, D. J. 2008. Constructivism: Implications for the design and delivery of instruction. Accessed on 08/12/2008 from http://www.iris.nyitedu/kkhoo

Duke, B. Harper, G. and Johnston, M. 2013. Connectivism as a Digital age learning theory. *The International HETL Review,* Special Issue, 4-13.

Du Plessis, P. G., Conley, E. and Du Plessis, E. 2007. Teaching and Learning in South African schools. Pretoria: Van Schaik.

Du Plessis, A. and Webb, P. 2010. The CRAR3FS2 framework for developing teachers' ICT skills for Science Education through Cyberhunts. Accessed on 22/04/2013 from http://nmmu.ac.za

Du Toit, J. 2015. Teacher training and usage of ICT in education: New directions for the UIS global data collection in the post 2015 context. Paris: UNESCO.

Dzansi, D. Y. and Amedzo, K. 2014. Integrating ICT into Rural South African Schools: Possible solutions for challenges. *International Journal of Education and Science*, 6 (2): 341-348.

Edinburgh Council. 2015. Education, Children and families Committee. 1.1 Digital learning Rollout. Accessed on 06/07/2015 from http://www.edinburg.gov.uk

Education SA Magazine. 2014. Improving education with technology. Accessed on 09/12/2015 from http://www.edusamag.co.za

Education Labour Relation Council (ELRC). 2003. Policy Handbook for educators. Accessed on 15/05/2012 from http://www.education.gov.za

Engineering News. 2015. 'Appropriate use' of ICT in classrooms seen as helping turn SA's education tide. Accessed on 09/12/2015 from http://www.engineeringnews.co.za

Epignosis LLC. 2014. E-Learning Concepts, Trends, Applications. Accessed on 01/10/ 2015 from htpp://www.talentlms.com.

Ertmer, P. A. and Newby, T. J. 2013. Behaviorism, Cognitivism, Constructivism: Comparing Critical features from an Instructional design Perspective. *Performance Improvement quarterly*, 26 (2): 43-72.

Felix, U. 2005. E-learning pedagogy in the third millennium: the need for combining social and cognitive constructivist approaches. *ReCALL* 17 (1): 85-100.

Ferrari, A., Cachia, R. and Punie, Y. 2009. ICT as a driver for creative learning and innovative teaching. Accessed on 06/06/2011 from http://www.openeducationeuropa.eu/sites/default

Ford, M. and Botha, A. 2014. Education in South Africa: Is ICT the answer? National Science and Technology Forum. Accessed on 02/03/ 2015 from htpp://www.nstf.co.za.

Frempong, G., Reddy, V. and Kanjee, B. 2011. Exploring equity and quality education in South Africa using multilevel models. Compare: *A Journal of Comparative and International Education*. Accessed on 23/10/2011 from http://www.tandfonline.com/loi/ccom20

Garcia, E., Brown, M. and Elbeltagi, I. 2013. Learning within a Connectivist Educational Collective Blog Model: Case study of UK Higher Education. Retrieved from htpp://www.ejel.org

Gauteng Department of Education. 2007a E-Learning Solutions Project. Accessed on 13/03/2013 from http://www. Nstf.co.za/showproperty?nodepath

Gauteng Department of Education. 2007b. Guidelines for teacher training and Professional Development in ICT. Pretoria: Government Printing works.

Gauteng Department of Education. 2011. Guidelines for management and usage of ICTs in public schools. Accessed on 20/03/2012 from http:// www.education.gpg.gov.za

Gauteng Department of Education. 2014. The Five Year 10 Pillar Education Programme: Presentation for the MEC's Consultative meetings. Accessed on 14/01/2016 from http://www.education.gpg.gov.za

Ghanaian Ministry of Education. 2015. ICT in Education Policy. Accessed on 15/10/2015 from http:// www.moe.gov.gh/assets/media

Given, L. M, Winkler, D. and Willson, R. 2014. Qualitative Research Practice: Implications for the Design and Implementation of a Research Impact Assessment Exercise in Australia. Accessed on 24/08/2014 from http://www.csu.edu.au/ripple/qualimpact

Greer, R., Koran, J. and White, L. 2016. A Beginning Model to Understand Teacher Epistemic Beliefs in the Integration of Educational Technology.

Guba, E. C. and Lincoln, Y. S. 1994. Competing Paradigms in Qualitative Research. In Denzin, N.K., Lincoln, Y.S. (Eds), Handbook of Qualitative Research. Thousand Oaks, CA: Sage Publications, pp. 105-117.

Gulbahar, Y. and Guven, I. 2008. A survey on ICT usage and the Perceptions of Social Studies Teachers in Turkey. *Educational technology and Society,* 11 (3): 37-51.

Hallissy, M., Butler, D., Hurley, J. and Marshall, K. 2012. Redesigning Education: Meeting the challenges of the 21st century. Accessed on 07/04/2013 from http://www.pil-network.ie/docs/MSLearningPapers

Harper, M. and Cole, P. 2012. Member checking: Can Benefits be Gained Similar to Group Therapy? *The Qualitative Report,* 17 (2): 510-517.

Hart, S. A. and Laher, S. 2015. Perceived usefulness and culture as predictors of teachers' attitudes towards educational technology in South Africa. *South African Journal of Education,* 35 (4): 1-13*.*

Hashemnezhad, H. 2015. Qualitative Content Analysis Research: A Review Article. *Journal of ELT and Applied Linguistics,* 3 (1)*.*

Hawkridge, D. 2006. Computers in Third World schools: African Advances. *Innovations in Education & Training International (IETI)*, 28 (1): 55-70.

Hennessy, S. Harrison, D. and Wamakote, L. 2010. Teacher factors influencing classroom use of ICT in Sub-Saharan Africa. *Itupale Online Journal of African Studies*, 2: 39-54.

Hennessy, S., Ruthven, K. and Brindley, S. 2010. Teacher perspectives on integrating ICT into subject teaching: Commitment, constraints, caution and change. Accessed on 08/17/2011 from http://www.tandfonline.com

Hsieh, H. F. and Shannon, S.E. 2005. Three approaches to qualitative content analysis. *Qualitative Health Research*, 15, (9): 1277-1288.

Human Sciences Research Council (HSRC). 2012. The Highlights from TIMSS 2011: The South African Perspective. HSRC: Pretoria.

Hunde, A.B. and Tacconi, G. 2013. Pulling and Pushing forces for ICT use in initial teacher preparation for secondary schools. *US-China Education Review,* 3 (10).

Hung, D. 2001. Theories of learning and Computer-Mediated Instructional Technologies. Accessed on 03/07/2011 from http://www.tandf.co.uk/journals

Hwang, D. J., Yang, H. and Kim, H. 2010. E-Learning in the Republic of Korea. UNESCO. Accessed on 09/02/2011 from http://iite.unesco.org

Isling Poromaa, P. 2013. Practices, social class and pedagogy in Swedish lower secondary schools. *Education Inquiry*, 4 (4): 649-669.

Ivankova, N., Creswell, J. W. and Clark V.P. 2007. Foundations and approaches to mixed methods research in First steps in Research. Pretoria: Van Schaik.

Izrik, G. 2001. Back to Basics: A Philosophical Critique of Constructivism. *Studies in Philosophy and Education,* 20: 157-175.

Janssen, J. D. 1997. Curriculum reform in South Africa: A Critical Analysis of Outcome-Based Education. Accessed on 02/10/2011 from htpp://repository.up.ac.za

Jonassen, D. H. 1991. Objectivism versus Constructivism: Do we need a New Philosophical paradigm? *Educational Technology Research and Development*, 39 (3): 5 -15. Accessed on 02/12/2015 from http://wwwjstor.org/stable/30219973

Kafyulilo, A. and Keengwe, J. 2013. Teachers' perspectives on their use of ICT in teaching and learning. Accessed on 15/07/2013 from http://link.springer.com/article/10.1007%2Fs10639-013-9259-7.

Kannan, S., Sharma, S. and Abdullah, Z. 2012. Principals' strategies for leading ICT integration: The Malaysian perspective. Accessed on 08/11/2012 from http://www.SciRP.org/journal/ce.

Kerr, B. 2006. A challenge to connectivism. Accessed on 08/12/2012 from http://billkerr2.blogspot.com

Kler, S. 2014. ICT Integration in Teaching and Learning: Empowerment of Education with Technology. Accessed on 07/09/2014 from http://dspace.chitkara.edu.in/jspui/bitstream/1/473/1/22019_IIE_Kler.pdf

Koehler, M. J. and Mishra, P. 2009. What is technological Pedagogical Content Knowledge? Accessed on 12/12/2015 from http://www.citejournal.org/articles/v9i1general1.pdf

Kop, R. 2011. The challenges to Connectivist learning on Open Online Networks: Learning Experiences during a Massive Open Online Course. *International Review of Research in Open and Distance Learning* (*IRRODL*), 12 (3).

Kop, R. and Hill, A. 2008. Connectivism: Learning theory of the future or vestige of the past? *The international Review of Research in Open Distance Learning. E-journaL*, 9 (3). Accessed on 12/12/2012 from http://www.irrodl.org/index.php/irrodl/article/view/523/1103.

Kozma, R. 2010. *ICT Policies and educational Transformation.* Paris: UNESCO.

Laaria, M. 2013a. Challenges encountered by principals during implementation of ICT in Public Secondary Schools. *International Journal of Sociological Research*, 4 (2).

Laaria, M. 2013b. Challenges in the implementation of ICT in Public Secondary Schools in Kenya. *International Journal of Social Science and Education*, 4 (1).

Leedy, P. D. and Ormrod J. E. 2005. *Practical Research: Planning and design.* 8th edition. New Jersey: Merrill Prentice Hall.

Lehtinen, E. 2010. Potential of teaching and learning supported by ICT for the acquisition of deep conceptual knowledge and the development of wisdom. Accessed on 12/03/2013 from http://www.portlandpress.com

Lesufi, P. 2014. Speech: Building a Socially Cohesive Education System in Gauteng. Accessed on 20/01/2016 from http://www.education.gpg.gov.za

Levinsen, K. T. 2010. To Deal with Fluidity in the Networked Society – Self-programming as a digital Literacy competence. Accessed on 10/07/2011 from http://vbn.aau.dk/en/publications

Levinsen, K. T. 2011. Fluidity in the Networked Society – Self-initiated learning as a digital literacy competence. *The Electronic Journal of e-Learning*, 9 (1): 52-62.

Livingstone, A. K. 2015. Students' perception of the potential of eLearning practices at the University of Guyana. *International Journal of Instructional Technology and Distance Learning*, 12 (10):23-45.

Livingstone, S. 2012. Critical reflections on the benefits of ICT in education. LSE Research Online. Accessed on 05/05/2013 from http://eprints.lse.ac.uk.

Lundall, P. and Howell, C. 2000. *Computers in schools:* A national survey of Information Communication technology in South African Schools. Cape Town: University of the Western Cape.

Lunenburg, F. C. 2010. The principal as Instructional leader. *National Forum of Educational and Supervision Journal*, 27 (4), 1-7.

Mac Callum, K., Jeffrey, L. and Kinshuk, K. 2014. Factors Impacting Teachers' Adoption of Mobile Learning. *Journal of Information Technology Education: Research*, 13: 141-162**.**

Makgato, M. 2012. Status of teachers' use of educational Technology: a case of some schools in South African semi-urban Locations. *International Proceedings of Economics Development and Research* (*IPEDR)*, 47 (23).

Makhura, D. 2015. Speech: State of the Province Address, 23 February 2015. Accessed on 22/06/2015 from http//www.gautengonline.gov.za

Makura, A. H. 2014. Students' Perceptions in a Higher Education Teaching and Learning Context: The case of a South African university. *Mediteranean Journal of Science Sciences*, 5 (11).

Malcolm, E. and Godwyll, F. 2008. Diffusion of Information Communication Technology in Selected Ghanaian Schools. Accessed on 04/11/2011 from http://www.icafrica.org

Maluleka, P. 2015. To understand SA's History Curriculum change in Democracy, let's first look at this change during transformation. Accessed on 26/11/2015 from News24.com

Mangesi, K. 2007. ICT in Education in Ghana. Accessed on 29/08/2013 from http://www.infodev.org

Maree, K. 2007. First steps in Research. Pretoria: Van Schaik.

Mayisela, T. 2013. The potential use of mobile technology: enhancing accessibility and communication in a blended learning course. Accessed on 24/05/2015 from http://www.sajournalofeducation.co.za

McLoughlin, C. and Lee, M.J.W. 2008. Mapping the digital terrain: New media and social software as catalysts for pedagogical change. Proceedings ascilite Melbourne.

McMillan, J. H. and Schumacher, S. 2010. Research in Education: Evidence-based Inquiry. 7th edition, Pearson: New Jersey.

Mdlongwa, T. 2012. Information and Communication technology (ICT) as a means of enhancing Education in Schools in South Africa: Challenges, Benefits and Recommendations. Africa Institute of South Africa. Policy Brief 80. Accessed on 15/01/2013 from http://www.ai.org.za

Mlitwa, N. B. W. and Nonyane, J. N. 2008. The status of ICT Access and use in South African schools: Comparing the Rural and Urban schools in the Mpumalanga Province. Accessed on 12/06/2012 from http://emerge2008.net/access/content/group/Mlitwa/access.

Mlitwa, N. W. and Koranteng, K. 2013. Integration of ICT into Curricula in Western Cape Schools: The Activity Theory Perspective. *The Journal of Community Informatics*, 9 (4). Accessed on 15/03/2016 from htpp://ci-journal.net/index.php/ciej/article/view/957/1055.

Mnisi, P. 2015. DBE's Progress with ICT Integration in schools: Innovation and e-Learning. Accessed on 08/12/2015 from http://www.dbe.gov.za

Moll, I. and Ndlovu, N.S. 2010. South Africa report. Introduction Challenges and Successes. Accessed on 27/06/2014 from http://www.ernwaca.org/panaf/pdf

Mooketsi, B. E. and Chigona, W. 2014. Different shades of success: Educator perceptions of government strategy on e-education in South Africa. *The Electronic Journal of Information Systems in Developing Countries (EJISDC)*, 64 (8).

Moore, J. L., Dickson-Deane, C. and Galyen, K. 2010. E-Learning, online learning and distance learning environments: Are they the same? *Internet and Higher Education*, 14:129-135.

Mortari, L. 2015. Reflectivity in Research Practice: An Overview of Different Perspectives. Accessed on 27/09/2016 from http://www.griffth.edu.au

Mouton, N., Louw, G.P. and Strydom, G.L. 2012. A Historical Analysis of the Post-apartheid Dispensation Education in South Africa (1994-2011). *International Business and Economics Research Journal,* 11(11): 1211-1222.

Msila, V. 2015. Teacher Readiness and Information and Communications Technology (ICT) Use in Classrooms: A South African Case Study. Accessed on 27/08/2016 from http://dx.doi.org

Msila, V. and Netshitangani, T. 2014. Education, Democracy and Pragmatism in post-apartheid South Africa: Explicating Cleo Cherryholmes. *Pensee Journal*, 76 (10): 276-283.

Muniandy, J. and Shuib, M. 2016. Learning Styles, language Learning Strategies and Fields of Study among ESL Learners. *Malaysian Journal of ELT Research*, 12 (1): 1-19

Mwalongo, A. 2011. Teachers' perceptions about ICT for teaching, professional development, administration and personal use. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 7(3): 36-49.

Mweli, H. M. 2013. Status Report on the Implementation of e-Education. Accessed on 08/12/2015 from http://www.dbe.gov.za

Ndibalema, P. 2014. Teachers' Attitudes towards the Use of Infromation Communication Technology (ICT) as a pedagogical Tool in Secondary Schools in Tanzania: The Case of Kondoa District. *International Journal of Education and Research*, 2 (2):1-16.

Ndlovu, N. S. and Lawrence, D. 2012. The quality of ICT use in South African classrooms. Accessed on 24/11/2013 from http://carnegie3.org.za

Nieuwenhuis, J. 2007. *Q*ualitative research designs and data gathering techniques in First Steps in research: Introducing qualitative research. Pretoria: Van Schaik.

Nkula, K. and Krauss, K. E. M. 2014. The integration of ICTs in marginalized schools in South Africa: Considerations for understanding the perceptions of in-service teachers and the role of training. *Proceedings of the 8th International Development Informatics Association Conference*, 241-261.

Noel, L. 2014. Teaching in a Digital Age. Accessed on 27/05/2015 from http://www.msvu.ca

Nyambane, C. O. and Nzuki, D. 2014. Factors Influencing ICT integration in teaching- A literature Review. *International Journal of Education and Research,* 2 (3), 1-18*.*

Osborne, J. 1993: Beyond Constructivism. Accessed on 27/09/2016 from http://www.mlrg.org

Osman, M., El-Hussein and Cronje, J. C. 2010. Defining mobile Learning in the Higher Education Landscape. *Educational Technology and Society*, 13 (3): 12-21.

Ouma, G. O., Awuor, F. M. and Kyambo, B. 2013. E-Learning readiness in Public Secondary Schools in Kenya. *European Journal of Open, Distance and E-Learning*. Accessed on 08/10/2016 from http://www.eurodl.org

Papaioannou, P. and Charalambous, K. 2011. Principals' attitudes towards ICT and their perceptions about the factors that facilitate or inhibit ICT integration in primary schools of Cyprus. *Journal of Information technology*, 10.

Peeraer, J. and Van Petegem, P. 2011. How to address integration of ICT in teaching practice? Research on factors influencing the use of ICT in education. Accessed on 21/03/2012 from http://www.formatex.info/ict/book/237-244.pdf.

Pegler, K., Kollewyn, J. and Crichton, S. 2010. Generational attitudes and teacher ICT use. *Journal of Technology and Teacher Education*, 18 (3): 443-458.

Rae, J. Roberts, C. and Taylor, G. 2006. Collaborative learning: A Connected Community Approach. *Issues in informing Science and Information Technology,* 3: 519 – 528.

Redecker, C. Ala-Mutka, K. and Punie, Y. 2010. Learning 2.0 - The impact of Social media on Learning in Europe. Accessed on 18/10/2012 from http://ipts.jrc.ec.europa.eu/

Roberts, S. and Potrac, P. 2014. Behaviourism, Constructivism and sports coaching pedagogy: A conversational narrative in the facilitation of player learning. *International Sport Coaching Journal*, 1: 180-187.

Roustaee, R., Suhaida Abd, Kadir, S. and Asimiran, S. 2014. A Review of Constructivist Teaching Practices*. Middle-East Journal of Scientific Research, 19*: 145-152.

Saavedra, A. R. and Opfer, V. D. 2012. *Teaching and learning 21st century skills: Lessons from the learning sciences.* Asia Society, Partnership for Global Learning.

Sankey, M., Birch, D. and Gardiner, M. 2010. Engaging students through multimodal learning environment: The journey continues. Accessed on 27/07/2012 from http://ascilite.org.au/conferences/sudney10

Sayed, Y. and Ahmed, R. 2011. Education quality in post-apartheid South African Policy: balancing equity, diversity, rights and participation. *Comparative Education*, 47 (1): 103-118.

SchoolNet SA. Annual Report. 2015. Accessed on 17/09/2015 from http://www.schoolnet.org.za

Sci-Bono Discovery Centre Annual Report 2014/15. 2015. Accessed on 18/01/2016 from http://www.sci-bono.co.za

Sekgwelea, S. M. 2007. Dynamic approach in the application of information communication technologies models in the provision of flexible learning for distance education. DEd thesis. Unisa, Pretoria.

Selwyn, N. 2012. Making sense of young people, education and digital technology: The role of sociological theory. *Oxford Review of Education*, 38, (1): 81- 96.

Serrao, A. 2012. Gauteng Online Media Briefing statement. Accessed on 10/03/ 2014 from htpp://www.gautengonline.gov.za

Shahnazarian, D. ,Hagemann, J., Aburto, M. and Rose, S. 2013. Informed Consent in Human Subjects Research. Accessed on 29/09/2016 from http://oprs.usc.edu.org

Shan Fu, J. 2013. ICT in Education: A critical Literature review and its implications. *International Journal of Education and Development using ICT (IJEDICT)*, 9 (1): 112-125*.

Shelly, G. B, Gunter R. E and Gunter G. A. 2010. Teachers discovering computers: Integrating Technology and Digital media in the classroom. 6th ed. Boston: Thomson Course Technology.

Shenton, A. K. 2004. Strategies for ensuring trustworthiness in qualitative research projects. *Education for information,* 22: 63-75.

Shin, N., Sutherland, L.M., Norris, C. A and Soloway, E. 2012. Effects of game technology on elementary student learning in mathematics. *British Journal of educational Technology*, 43 (4): 540-560.

Siemens, G. 2004. Connectivism: A learning Theory for the Digital Age. Accessed on 13/08/2012 from http://www.elearnspace.org

Siemens, G. 2008a. A brief history of networked learning. Accessed on 13/08/2012 from http:// www.elearnspace.org

Siemens, G. 2008b. Connectivism: Learning theory or pastime for the self-amused? Accessed on 13/08/2012 from http://www.elearnspace.org

Simon, M. K. 2011. Dissertation and scholarly research: Recipes for success. Accessed on 28/07/2013 from http://www.dissertationrecipes.com

Sipilä, K. 2014. Educational use of information and communication technology: Teachers' perspective. *Technology, Pedagogy and Education,* 23 (2): 225-241.

Sithole, K., Ikotun, B.D. and Onyari, E. K. 2012. Influence of generations' traits on teaching and learning in an Open Distant Learning (ODL) environment. Accessed on 27/05/2014 from http://www.unisa.ac.za.

Skinner, B. 1968. *The technology of teaching*. New York: Appleton-Century-Crofts.

Smit, P. J. 2013. Rationales for modern ICT Implementation into schools: A case of tablet PCs. Educational Science and Technology. Twente: University of Twente.

South African Institute for Distance Education (SAIDE). 2005. Managing ICTs in South African schools: A guide for school principals. Johannesburg: SAIDE.

South African Government Online. 2015: Isizwe Project. Accessed on 02/10/2015 from http://projectisizwe.org

Srivastava, P. and Hopwood, N. 2009. A Practical Iterative Framework for Qualitative Data Analysis. Accessed on 27/05/2014 from http://citeeerx.ist.psu.edu.

Starkey, L. 2010. Teachers' pedagogical reasoning and action in the digital age. *Teachers and Teaching: theory and practice*, 16 (2): 233-244.

Starkey, L. 2011. Evaluating learning in the 21st century: a digital age learning matrix. Accessed on 16/10/2015 from http://www.tandfoline.com/loi/rtpe20

Sukazi, J. and Ntshingila, D. 2013. Gauteng Online Media Briefing Statement. Accessed on 25/09/2012 from http:// www.politicsweb.co.za

Tay, L. Y, Lim, S. K., Lim, C. P. and Koh, J. H. L. 2012. Pedaqgogical approaches for ICT integration into primary school English and mathematics: A Singapore case study. *Australian journal of Educational Technology*, 28 (40): 740-754.

Tedla, B.A. 2012. Understanding the importance, impacts and barriers of ICT on teaching and learning in East African countries. *International Journal for e-Learning Security (IJeLS,* 2(3 /4): 199-207.

Tella, A., Tella, A., Toyobo, O. M., Adika, L. O and Adeyinka, A. A. 2007. An assessment of Secondary School Teachers' uses of ICTS: Implications for development of ICTs' use in Nigerian Secondary Schools. *The Turkish Online Journal of Educational Technology*, 6 (3).

Thanh, N. C. and Thanh, T. T. 2015. The Interconnection Between Interpretivist Paradigm and Qualitative methods in Education. *American Journal of Educational Science*, 1 (2):24-27.

The Highland Council, C. 2015. ICT in Learning Strategic Action Plan 2015. Accessed on 16/08/2015 from http://www.highland.gov.uk

Tire, T. and Mlitwa, N. 2008. ICT access and use in rural schools in South Africa: The Northern Cape Province. Cape Town: Cape Peninsula University of Technology.

Tuli, F. 2010. The basic distinction between qualitative and quantitative research in social sciences: Reflection on Ontological, epistemological and methodological Perspectives. *Ethiopian Journal of Educational Science,* 6 (1): 97-108.

Tupas, J. B. and Pendon, G. P. 2016. College Teachers' Educational Philosophy: A Step towards Improving Teaching Performance. *International Journal of Education & Multidisciplinary* Studies.3: 384-401.

Tziafetas, K., Avgerinos, A. and Tsampika, K*. 2013.* Views of ICT teachers about the introduction of ICT in primary education in Greece. *The Turkish Online Journal of Educational Technology,* 12 (1).

Uche, C. M., Kaegon, L. E. S. P., Okata, F. C. 2016. Teachers' Level of Awareness of 21st Century Occupational Roles in Rivers State Secondary Schools. *Journal of Education and Training Studies*, 4 (8): 83- 92.

UNESCO. 2008. Strategy Framework for Promoting ICT Literacy in the Asia-Pacific Region. Accessed on 15/07/2012 from http://enesdoc.unesco.org

UNESCO. 2012. ICTs for curriculum change. Paris, UNESCO Policy Brief. Accessed on 18/10/2014 from http://www.iite.unesco.org

UNESCO. 2015. Information and Communication Technology (ICT) in Education in Sub-Saharan Africa: A comparative analysis of basic e-readiness in schools. Accessed on 20/01/2016 from http://unesdoc.unesco.org

UNICEF. 2012. South African mobile generation: Study on South African young people on mobiles. Accessed on 13/09/2015 from http://www.unicef.org/southafrica/SAF_resources_mobilegeneration.

UNISA. 2012. Cellphone Living and Learning styles among secondary school learners in Gauteng. Bureau of Market Research. Accessed on 29/09/2016 from http://www.unisa.ac.za

Van der Berg, S. 2016. What the ANAs tell us about socioeconomic learning gaps in South Africa. Accessed on 30/09/2016 from http://resep.sun.ac.za

Van der Berg, S., Taylor, S., Gustafsson, M., Spaull, N. and Armstrong, P. 2011. Improving Education quality in South Africa. Accessed on 30/07/2013 from http://resep.sun.ac.za

Van Rij, V. and Warrigton, B. 2010. Teaching and learning for an ICT revolutionized society. Accessed on 12/04/2012 from https://farhorison.portals.mbs.ac.uk

Van Wyk, K. 2014. Education in South Africa: Is ICT the answer? National Science and Technology Forum. Accessed on 12/07/2014 from htpp://www.nstf.co.za

Vasilachis de Gialdino, I. Ontological and Epistemological Foundations of Qualitative Research. 2009. FQS, 10, (2). Accessed on 17/06/2013 from http://www. Qualitative-research.net/index.php/fqs/article /views/1299/3163.

Verhagen, P. 2006. Connectivism: a new learning theory? Accessed on 19/06/2012 from http://www.surfspace.nl/nl//Redactieomgeving/Publicaties/Documents/Connecti vism%20

von Glasersfeld, E. 2014. A Constructist Approach to teaching. Accessed on 12/06/2015 from http://wwwunivie.ac.at/constructivismEvG/papers/172.pdf

Voogt, J. 2012 ICTs for Curriculum Change. UNESCO Institute for Information Technologies in Education. Accessed on 23/04/2014 from http://www.iite.unsco.org

Vygotsky, L.S. 1978. *Mind in society: The Development of the Higher Psychological Processes.* Cambridge, MA: Harvard University Press.

Wang, Q. 2008. A generic model for guiding the integration of ICT into teaching and learning. *Innovations in Education and Teaching International,* 45: 411-419.

Wildemeersch, D. and Jütte, W. 2016. Digitalisation and the Education and Learning of Adults. Accessed on 21/09/2016 from http://www.rela.ep.liu.se

Wilson, A. and McKinney, *S. 2012.* Glow or Glimmer? A case study of ICT innovation in a Scottish secondary school. *Scottish Educational Review,* 44 (1): 57-69.

Yahya, S., Ahmad, E. A. and Jalil, K. 2010. The definition and characteristics of ubiquitous learning: A discussion. *International Journal of Education and Development using Information and Communication Technology ,* 6, (1), 117-127.

Yin, R. K. 2009. *Case study research: Design and methods.* Fourth edition. SAGE: Los Angeles.

Yin, R. K. 2011. Qualitative Research from Start to Finish, Guilford Press, New York, NY.

Zaidel, M. and Guerrero, O. 2008. Globalisation of knowledge discovery and information retrieval in teaching and learning. *Journal of College Teaching and Learning*, 5 (1), 87-92.

APPENDIX A1: LETTER OF CONSENT - TEACHERS

UNISA | college of education

Dear Participant

My name is Shirley Mukhari. I am a student at the University of South Africa in the College of Education under the supervision of Professor Van den Berg. You are invited to participate in a research project entitled:

Teachers' experience on Information and Communication Technology (ICT) use in teaching and learning in urban schools. The purpose of this study is to determine ICT usage in teaching and learning and the factors that impede the full utilisation of ICTs in South African urban schools.

The following interview was developed to ask you a few questions regarding *Teachers' experience on Information and Communication Technology use in teaching and learning in urban schools*. I hope that this study can elicit the reasons and the obstacles that prevent teachers from integrating ICTs in their teaching practices and make recommendations for ICT adoption for better teaching and learning. There are no identified risks from participating in this study.

This study involves audio recording of your interview with the researcher. Neither your name nor any other identifying information will be associated with the audio recording or the transcript. The participant's identity will be anonymous and what will be said during the interview will be kept in the strictest confidentiality. Your participation is voluntary and you may withdraw from participating without any consequence. The interview will take 30 to 45 minutes of your time to complete. There will be no compensation for participating in this study.

The report of the findings of this research study will be communicated to all the participants and I can be contacted at mukhass@unisa.ac.za or 0833280298. Thank you for your consideration. Your help is greatly appreciated.

Your signature on the reply slip indicates that you have read the above information, are an adult and agree to participate in the study of *Teachers' experience on Information and Communication Technology (ICT) usage in teaching and learning in urban schools.*

Yours Sincerely

SS Mukhari

Signature

_____

30 April 2014

The Principal

XXXXXXXXXX Primary School

35194 Mmupudu Street

Mamelodi East

0122

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

My name is Shirley Mukhari. I am a DED student at the University of South Africa in the College of Education under the supervision of Professor Van den Berg. The research I wish to conduct involves **Teachers' experience on Information and Communication Technology (ICT) use in teaching and learning in urban schools.** The purpose of this study is to determine ICT usage in teaching and learning and the factors that impede the full utilisation of ICTs in South African urban schools.

I am writing to request your permission to interview the principal and the teachers who implement and integrate ICTs in teaching their subjects. The interviews will be conducted after school hours and each interview will take 30 to 45 minutes. I will also do audio recordings during the interview sessions. The information obtained will be kept in the strictest confidentiality and will be used for this research purpose only.   It is my presumption that the research findings will make a credible contribution in the teachers' adoption and integration of ICTs in teaching and learning.

If you require any further information, please contact me at mukhass@unisa.ac.za or 0833280298.

Yours sincerely

SS Mukhari

…………………………………………….

APPENDIX B: REPLY SLIP

Teachers' experience of Information and Communication Technology (ICT) usage in teaching and learning in urban schools.

Complete this reply slip and return it by either using the enclosed envelope.

OR

E-mail it to me at mukhass@unisa.ac.za.

OR

Telephone at 012 429-6692

RESEARCH REPLY SLIP

I am willing to be interviewed   Yes   No
                                                              ☐   ☐

I am interested in being interviewed, but I would like to discuss the research project for some

clarifications before engaging in the project.   Yes   ☐No   ☐

My name is   _____

Telephone   _____

Address   _____

              _____

              _____

If I do not hear from you, I will assume that you are not interested in participating in the study.

Your cooperation will be highly appreciated.

APPENDIX C: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

The District Manager

Tshwane South District

President Towers Building

Pretoria

0001

Dear Mrs Kekana

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

My name is Shirley Mukhari. I am a student at the University of South Africa in the College of Education under the supervision of Professor Van den Berg. The research I wish to conduct for my DED studies involves **Teachers' experience on Information and Communication Technology use in teaching and learning in urban schools.** The purpose of this study is to determine ICT usage in teaching and learning and the factors that impede the full utilisation of ICTs in South African urban schools.

I am hereby seeking your consent to visit primary and high schools teachers and principals in Mamelodi (Tshwane South District) to conduct interviews regarding ICT usage in teaching and learning across the school curriculum. I have attached a copy of my proposal.

The participant's identity will be anonymous and what will be said during the interview will be kept in the strictest confidentiality. Your participation is voluntary and you may withdraw from participating without any consequence. The interview will take 30 to 45 minutes of your time to complete. There will be no compensation for participating in this study.

The report of the findings of this research study will be communicated to all the participants and I can be contacted at mukhass@unisa.ac.za or 0833280298. Thank you for your consideration. Your help is greatly appreciated.

Yours sincerely

SS Mukhari

APPENDIX D: APPLICATION TO DO RESEARCH

GAUTENG DEPARTMENT OF EDUCATION

RESEARCH REQUEST FORM

REQUEST TO CONDUCT RESEARCH IN INSTITUTIONS AND/OR OFFICES OF THE GAUTENG DEPARTMENT OF EDUCATION

1. PARTICULARS OF THE RESEARCHER

1.1	**Details of the Researcher**	
Surname and Initials:	Mukhari SS
First Name/s:	Shirley Sympathonia
Title (Prof / Dr / Mr / Mrs / Ms):	Mrs
Student Number (if relevant):	420 830-7
ID Number:	6103290641089
Gender (Male/Female):	Female

1.2	**Private Contact Details**	
Home Address		*Postal Address (if different)*
25206 Khutsong Ext		P O Box 79346
Mamelodi East		Mamelodi East
		Rethabile

Postal Code:	0122
Tel: 012 801-6488	
Cell: 0833280298	
Fax: N/A	
E-mail: mukhass@unisa.ac.za	

2. PURPOSE AND DETAILS OF THE PROPOSED RESEARCH

2.1	Purpose of the Research (Place cross where appropriate)	
Undergraduate Study – Self		
Postgraduate Study – Self		x
Post-Doctoral Study		
Private Company – Commissioned by Provincial and/or National Government Department/s		
Private Research by Independent Researcher		
Non-Governmental Organisation		
National Department of Education		
Commissions and Committees		
Independent Research Agency		
Statutory Research Agency		
Independent Study by Higher Education Institution		

2.2	Full title of Thesis / Dissertation / Research Project
Teachers' experience of Information and Technology (ICT) usage in teaching and learning in urban schools.	

2.3	Value of the Research to Education (Attach Research Proposal)
To encourage teachers to adopt and appropriate ICTs for effective teaching and learning.	

2.5	Student and Postgraduate Enrolment Particulars (if applicable)	
Name of institution where enrolled:	Unisa	
Degree / Qualification:	DED	
Faculty:	Education	

Department:	Curriculum Studies
Name of Supervisor / Promoter:	Prof G. Van den Berg

2.6	Employer (where applicable)	
Name of Organisation/School:	Unisa	
Position in Organisation:	Lecturer	
Head of Organisation:	Pro PM Sebate	
Street Address:	Preller Street	
	Unisa	
Postal Code:	0003	
Telephone Number (Code + Ext):	012 429-8220	
Fax Number:	N/A	
E-mail:	sebatpm@unisa.ac.za	

2.7	PERSAL Number (where applicable)

1	1	6	1	2	0	5	3

3.   PROPOSED RESEARCH METHOD/S

(Please indicate by placing a cross in the appropriate block whether the following modes would be adopted)

3.1   *Questionnaire/s (If Yes, supply copies of each to be used)*

YES		NO	x

3.2   *Interview/s (If Yes, provide copies of each schedule)*

YES	x	NO	

3.3   *Use of official documents*

YES	x	NO	
If Yes, please specify the document/s:		
White Paper on e-Education; Guidelines for Teacher Training and professional development		
Guidelines on the management and usage of ICTs in public schools in Gauteng; Guidelines for Schools ICT Hardware Specifications		

3.4   *Workshop/s / Group Discussions. (If Yes, Supply details)*

YES	x	NO	
Focus groups of the School Based Support Teams. These will be teachers who have previously interacted with the process of providing learning support for learners presenting with learning difficulties.		

3.5   *Standardised Tests (e.g. Psychometric Tests)*

YES		NO	X
If Yes, please specify the test/s to be used and provide a copy/ies		

4.   **INSTITUTIONS TO BE INVOLVED IN THE RESEARCH**

4.1   *Types of Institutions. (*Please indicate by placing a cross alongside all types of institutions to be researched).*

INSTITUTIONS	Mark with "X" here
Primary Schools	x
High Schools	x
Technical Schools	

ABET Centres	
ECD Sites	
LSEN Schools	
Further Education and Training Institutions	
Other/ Note: I will focus on the senior phase teachers	x

4.2   *Number of institution/s involved in the study.* **(Kindly place a sum and the total in the spaces provided).**

Type of Institution	Total
Primary Schools	**5**
High Schools	**5**
Technical Schools	
ABET Centres	
ECD Sites	
LSEN Schools	
Further Education and Training Institutions	
Other	
GRAND TOTAL	**10**

4.3   *Name/s of institutions to be researched.* **(Please complete on a separate sheet and append if space is deemed insufficient).**

Name/s of Institution/s
Tlakukani Primary School
Sikhanyisele Primary School
Shirinda Primary School

Mfundzo Primary School
Mogale Primary School
Jafta Mahlangu High School,
Gatang High School
Lehlabile High School,
Solomon Mahlangu High School
Mamelodi High School

4.4 *District/s where the study is to be conducted.* **(Please mark with an "X").**

District	
Ekurhuleni North	
Ekurhuleni South	
Gauteng East	
Gauteng North	
Gauteng West	
Johannesburg Central	
Johannesburg East	
Johannesburg North	
Johannesburg South	
Johannesburg West	
Sedibeng East	
Sedibeng West	
Tshwane North	
Tshwane South	x

District	
Tshwane West	

Office/s (Please indicate)
N/A

NOTE:

If you have not as yet identified your sample/s, a list of the names and addresses of all the institutions and districts under the jurisdiction of the GDE is available from the department at a small fee.

4.5 *Number of learners to be involved per school.* **(Please indicate the number by gender).**

Grade	*1*		*2*		*3*		*4*		*5*		*6*	
Gender	B	G	B	G	B	G	B	G	B	G	B	G
Number	N/A											

Grade	*7*		*8*		*9*		*10*		*11*		*12*	
Gender	B	G	B	G	B	G	B	G	B	G	B	G
Number	N/A											

4.6 *Number of educators /officials involved in the study.* **(Please indicate the number in the relevant column).**

Type of staff	Educators	HODs	Deputy Principals	Principal	Lecturers	Office Based Officials
Number	10 Individual	N/A	5 Individual interviews	N/A	N/A	N/A

	interviews					

4.7 *Are the participants to be involved in groups or individually?* Please mark with an "X".

Participation	
Groups	
Individually	x

4.8 *Average period of time each participant will be involved in the test or any other research activity* (Please indicate time in minutes)

4.9 *Time of day that you propose to conduct your research.* Please mark with an "X".

School Hours	During Break	After School Hours
		X

4.10 *School term/s during which the research would be undertaken.* Please mark with an "X".

First Term	Second Term	Third Term
	x	

DECLARATION BY THE RESEARCHER
1. *I declare that all statements made by myself in this application are true and accurate.*
2. *I have read and fully understand all the conditions associated with the granting of approval to conduct research within the GDE, as outlined in the GDE Research Briefing Document, and undertake to abide by them.*
3. *Should I fail to adhere to any of the approval conditions set out by the GDE, I would be in breach of the agreement reached with the organisation, and all privileges associated with the granting of approval to conduct research, would fall away.*

Signature:	SS Mukhari
Date:	2014/05/07

DECLARATION BY SUPERVISOR / PROMOTER / LECTURER
I declare that: -
1. *The applicant is enrolled at the institution / employed by the organisation to which the undersigned is attached.*
2. *The overall research processes meet the criteria of:*   • *Educational Accountability*   • *Proper Research Design*   • *Sensitivity towards Participants*   • *Correct Content and Terminology*   • *Acceptable Grammar*   • *Absence of Non-essential / Superfluous items*

Surname:	Van den Berg
First Name/s:	Geesje
Institution / Organisation:	University of South Africa

Faculty:	College of Education
Department:	Curriculum and Instructional Studies
Telephone:	012 4294895
Fax:	0866133903
Cell:	0829219771
E-mail:	*vdberg@unisa.ac.za*
Signature:	
Date:	2014-05-09

N.B. This form (and all other relevant documentation where available) may be completed and forwarded electronically to Nomvula Ubisi at nomvulau@gpg.gov.za. The last page of this document must however contain an original signature and may be faxed or hand delivered. Mark fax - For Attention: Nomvula Ubisi at 086400908 (fax) or hand deliver (in closed envelope) to Room 525, 111 Commissioner Street, Johannesburg.

APPENDIX E1: PERMISSION TO CONDUCT RESEARCH – GDE
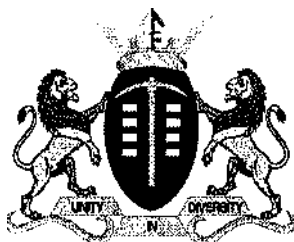
GAUTENG PROVINCE

Department: Edue<1tion

REPUBLIC OF SOUTH AFRICA

For administrative
use: Reference no:
02015 *I* 253

GDE RESEARCH APPROVAL LETTER

Date: 11 August 2014	
Validity of Research Approval	11 August 2014 to 3 October 2014
Name of Researcher	Mukhari, S.S.
Address of Researcher	PO Box 79345 Mamodi East Rathibile 0122
Telephone Number	012 801 6488; 083 328 0298
E-mail address:	mukhass@unisa.ac.za
Research Topic:	Teachers' experience of Information Technology (ICT) usage in teaching and leraning in urban schools
Number and type of schools	Five Primary and Five High schools

Re: Approval in Respect   of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

Making education a societal priority

Office of the Director: Knowledge Management and Research

gth Floor, 111 Commissioner Street. Johannesburg, 2001

P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506

Email: David.Makhado@gauteng.gov.za

Website: www.education.gpg.gov.za

APPENDIX E2: GAUTENG'S PERMISSION TO DO RESEARCH IN SCHOOL'S – TSHWANE SOUTH

Enquiries   : Sello Ngwenya
Sub-directorate : Education Operations and Support
Telephone   : 012 401 6322
Mobile   : 083 571 2582
Fax - 2 – Email : 086 557 4276
E-mail   : Sello.Ngwenya@gauteng.gov.za
Reference Number : 28/3/3

GAUTENG PROVINCE

Department: Education

REPUBLIC OF SOUTH AFRICA

To :	**Mukhari S.S (Researcher)**
From:	**H.E. Kekana (Director: Tshwane South District)**
Date:	**29 August 2014**
Subject:	**Permission to conduct research.**

Mukhari S.S
P.O Box 79346
Mamelodi East
Rethabile, 0122
Telephone number: 012 801 6488; 083 328 0298
e-mail: mukhass@unisa.co.za; mukhass@unisa.ac.za

Cc: The Principal and SGB

Dear Sir/ Madam

PERMISSION TO CONDUCT RESEARCH: MUKHARI S.S

Your research application has been approved by Head Office. The full title of your research is "Teachers' experiences of Information Technology (ICT) usage in teaching and learning in urban schools". You are expected to adhere strictly to the conditions given by Head Office. You are also advised to communicate with the school principal/s and/or SGB/s of the targeted schools regarding your research and time schedule.

Our commitment of support may be rescinded if any form of irregularity/ no compliance to the terms in this letter or any other departmental directive/ if any risk to any person/s or property or our reputation is realised, observed or reported.

Terms and conditions

1. The safety of all the learners and staff at the school must be ensured at all times.
2. All safety precautions must be taken by the researcher and the school. The Department of Education may not be held accountable for any injury or damage to property or any person/s resulting from this process. The school/s must ensure that sound measures are put in place to protect the wellness of the researcher and his/ her property.

Page 1 of 2

Making education a societal priority

NB Kindly submit your report including findings and recommendations to the District at least two weeks after conclusion of the research. **The permission granted will expire as per Head Office determination on the letter of permission issued to you.**

You may be requested to participate in the Department of Education's mini-research conference to discuss your findings and recommendations with departmental officials and other researchers.

The District wishes you well.

Yours sincerely

Mrs. H.E Kekana
Director: Tshwane South District
Date : 01/09/2014

UNISA | college of education

Research Ethics Clearance Certificate

This is to certify that the application for ethical clearance submitted by

SS Mukhari [04208307]

for a D Ed study entitled

Teachers' experience of Information and Communication Technology usage in teaching and learning in urban schools

has met the ethical requirements as specified by the University of South Africa College of Education Research Ethics Committee. This certificate is valid for two years from the date of issue.

Prof KP Dzvimbo
Executive Dean : CEDU

Dr M Claassens
CEDU REC (Chairperson)
mcdtc@netactive.co.za

Reference number: 2014 MAY /04208307/MC

19 MAY 2014

APPENDIX G: INTERVIEW SCHEDULE FOR TEACHERS

Biographical Information

Gender: **Male** ☐ **Female** ☐

Name of the school:

…..……………………………………………………………………………………………..

Qualifications:

……………………………………………………………………………………………………..

Teaching experience: ……………….. years

Subjects taught:

……

Grade(s):

………

1.   Do you have an ICT laboratory/centre?

Yes ☐   No ☐

If yes, how many computers are available at the ICT laboratory/ centre?

2.   What ICT tools are available at your school?

3.   Have you received any training on the integration and implementation of ICTs in your teaching

       activities?

Yes ☐ **No** ☐

Explain:

4.   How confident are you about your ability to use computers and other ICT instruments for

teaching   and learning?

Explain:

5.   Do you feel you have the necessary skills to integrate ICTs in your daily teaching

responsibilities?

Yes ☐ **No** ☐

Explain:

6.   Do all teachers at your school integrate ICTs in their teaching activities?

☐   271

Yes ☐ **No**

Explain

If not all teachers use ICTs for delivering their subjects, in which subjects are ICTs used for the facilitation of teaching and learning?

7. Do you have all the necessary application software such as word processor, database, etc required for the facilitation of teaching and learning?

Yes ☐ **No** ☐

Explain:

8. Do you use these ICT programs in teaching your subject to provide new ways of enhancing learners' experiences of acquiring knowledge?

Yes ☐ **No** ☐

Explain:

9. Does the use of ICTs proof to be a better method of teaching learners as compared to the traditional methods of teaching?

Yes ☐ **No** ☐

Explain:

10. Do learners learn better as a result of using ICTs in teaching your subject matter?

Yes ☐ **No** ☐

Explain:

11. How do you use ICTs to cater for learners' learning needs?

12. Do you use the computer and the internet to update your subject knowledge?

Yes ☐ **No** ☐

Explain:

13. Do you have internet access?

Yes ☐ **No** ☐

Explain:

14.   Do you use the internet to update your professional development?

Yes ☐   **No** ☐

Explain

15.   Do you give learners tasks which prompt the use of the internet?

For which subjects do you use the internet?

16.   Do you use the email to post homework to your learners?

Yes ☐   **No** ☐

Explain

17.   As digital age children, the majority of the learners in urban and rural areas do have smart

phones. Do you allow them to use their smart phones for learning?

Yes ☐   **No** ☐

Explain

18.   Do you regard using ICTs as having any benefits?

Yes ☐   **No** ☐

Give examples:

19.   Taking globalisation, the qualities required for the 21st century, the knowledge society, social

and   economic development into consideration, do you see your role as a teacher being the same

as   before?

Why do you feel it is necessary to use ICTs in teaching today's generation (Y-generation)?

Explain:

20.   The South African education policy states that "All South African learners must be ICT capable

by   2025/2030. Do you share the same vision with the policy makers and the department of

education?

If the answer is yes, please explain:

If the answer is no, give reasons why:

Yes ☐ **No** ☐

21.   What challenges do you encounter in integrating ICTs in your responsibilities?

22.   What changes are needed for maximal use of ICT in teaching and learning?

THANKS FOR YOUR PARTICIPATION!

Biographical information

Gender: Male ☐   Female ☐

Qualifications:

Name of the school:

Number of years as a school principal:

1.   As the principal of the school what is your vision on the use of ICT in teaching and learning?

Explain:

2.   Does your school have the necessary ICT equipment for the facilitation of teaching and

       learning?

Yes/No

Explain:

3.   The National Education Policy on ICT maintains that every South African learner must be ICT

       capable by 2025, how do you as the principal enforce this policy?

Comment:

4.   Do all teachers use ICT in their daily teaching activities?

       Yes ☐   **No** ☐

Explain

5.   Do all teachers use ICT in their administrative tasks?

       Yes ☐   **No** ☐

Explain:

6.   What changes have been noticed as a result of using ICTs at your school?

Explain:

7.   Is teaching and learning improving as a result of using ICTs at your school?

       Yes ☐   **No** ☐

Explain:

8.   What factors inhibit ICT usage at your school?

Mention them:

9.   What is your school policy in terms of ICT integration in teaching and learning at your school?

Explain:

10.   Are ICTs used across the curriculum or are they employed in some subjects?

Explain:

11. How do you engage parents and the private sector in ensuring that ICTs are well integrated in teaching and learning at your school?

Explain:

12. What measures can you introduce to ensure that your teachers and learners comply with the 21st century requirements and the policy of the National Department of Education on eLearning and ICTs in education?

Mention them:

13. What do you recommend in terms of bridging the gap in the ability of learners and teachers to use ICTs in teaching and learning?

Explain:

THANKS FOR YOUR PARTICIPATION!

Quotes	Codes	Emergent themes
"According to the number of learners that we are having, 25 computers are not many or enough for all the learners. *"We have twenty five computers for the learners"* *"We need facilities for the learners; printers, projectors, emails for learners."*	**Insufficient computers**	
"We need Xitsonga and Isizulu software to equip learners with reading and language skills *"I've got software called Workspace, it has all learning areas"* *"We do not have computer programs for all the subjects"* *"Not at school but in my own laptop* [software]*."*	**Lack of educational software**	**Inadequate ICT infrastructure**
"The computer lab is so small. I mean that there should be three more computer classes." *"The person who is in charge of the computer laboratory centre lab doesn't have any knowledge about ICTs and he does not open the computer lab."*	**Limited and unused space**	
"Another thing that makes some work difficult is that many times we do not have power. *"The computers and the internet depend on an uninterrupted supply of electricity*	**Power interruptions**	

"We are being discouraged from using the computers and we resort to chalk and talk method".	**Lack of ICT skills**	
"Some methods used inside the computer are very difficult because we were not trained by the government on how to use them." *"It is a challenge… I have not yet been trained; I am only using the knowledge that I have. We need to be workshopped."* *"I am very confident. I haven't received any formal training in ICT but I do know how to use ICT instruments through self- training."*	**ICT training**	**Teachers' proficiency in ICT usage**
"I got training but it is some time ago. I think it is 2009. "Computer literacy was one of my compulsory courses at varsity." *"I got training but it is some time ago. I think it is 2009. The training was for one day for about an hour."* *"I attended the course at Valhaal where they taught us how to draft anything that there is about a method of teaching and learning, for instance, how to draft a working mark sheet, anything that has something to do with learning."* *"We still have a problem with teachers who cannot use the equipment. That is the challenge we have."*	**Confidence**	
"I use ICT for lesson planning and allow learners to use cell phones for internet and to record what I am		

teaching them." *"I'm not confident, not that much capable, I'm not 100% confident"* *"We need more training because we have not received enough training from the government on how to use computers and tablets and the software built inside them."* *"Some [teachers] send learners to do research on the internet without accompanying them."* *"We still have a problem with teachers who cannot use the equipment. That is the challenge we have."* *"We got old teachers here, that even if you can try to involve them in terms of using the ICT, they are not part and parcel of it, they are not willing actually."* *"Some were born before technology; some of them are about to exit to retire, so as a result they are not interested per se in being computer literate so most of them are computer illiterate."* *"Some of my colleagues still believe that chalk and talk is the best way, they close their eyes, close their ears.*	279 **Lack of interest and resistance**	

Interviewer: Good afternoon, I am Shirley Mukhari from the University of South Africa and I am currently undertaking research studies on the teachers' experience on ICT usage in urban schools. This interview is conducted to seek and gather information pertaining to teachers and principals' experience on the use of the ICTs in teaching and learning. The purpose of this interview is to determine the use of ICT for teaching and learning with the focus being on teachers as key figures in the teaching and learning environment. I have chosen you to participate in this interview, since at your school, you use computers. I will not use your name to ensure anonymity. What you say will be kept in confidence and one other thing. I encourage you to answer all questions as this will help me to gain a better understanding of what I am researching. Remember that you are not under any obligation to take part in this exercise and in order to continue with this interview, I need your consent to proceed. One other thing is that if you don't wish to continue, you can stop as you wish. I am going to refer to you as teacher #8 and thank you for agreeing to participate in this interview.

Interviewer: Your gender?

Interviewee: Female

Interviewer: What are your qualifications?

Interviewee: I have a BA degree in education.

Interviewer: The name of your school?

Interviewee: XXXXXXXXXX High School.

Interviewer: For how long have you been a teacher?

Interviewee: Twelve years.

Interviewer: Okay, what subjects do you teach?

Interviewee: Currently I am teaching Gr 12 Science, grade 8 and 9 English, Grade 10 but I have been teaching Technology and Physical sciences as well.

Interviewer: And do you have an ICT laboratory at your school?

Interviewee: Yes, we do though it is not functional, but we do

Interviewer: What ICT tools are available at your school?

Interviewee: Ja, we've got a lot, we've got computers, internet access, printers, you name it, we've got.

Interviewer: Can you tell us exactly the number of computers that you have?

Interviewee: Well in the administration block we've got plus minus 12, because each and every HOD has got a computer in their office, with internet access as well then there is a computer lab which was build by GDE, the Gauteng on-line one, but it has never been functional since Gauteng on-line was always off line so it's just there, it's got 15 computers in it.

Interviewer: Okay. Then have you received any training on the integration and implementation of ICTs in your teaching activities?

Interviewee: You mean privately or from the GDE?

Interviewer: Yes from the GDE?

A: Ja, I did it privately, I did, I studied computer literacy, I've got a basic computer literacy certificate and the advanced one. Then I think it was in 2009, we attended the workshop on CAT (Computer Applications technology). It was NCS training. That is where they showed us how to implement.

Interviewer: But how long did that training take?

Interviewee: From 8 to 4. For five days.

Interviewer: Okay, then how confident are you about your ability to use computers and other ICT instruments for teaching and learning?

Interviewee: Ja, I am very confident. I use it every now and then, I like, especially for grade 8, Natural Science, I bring in the projector, I take my personal laptop, play DVDs especially on interactions, interdependence of plants and animals, bring interesting videos, so that they can see how plants and animals are inter-related and dependent on each other. So I use it a lot.

Interviewer: Do you feel have the necessary skills to integrate ICTs in your daily teaching responsibilities?

Interviewee: Like me personally?

Interviewer: Yes.

Interviewee: Yes, I do.

Interviewer: Okay, can you explain.

Interviewee: I am very computer literate, to an extend that even our administrators when they experience problems on their PCs, they would call me from class to come and assist them so , yes I am confidently well trained in that regard.

Interviewer: And you use that for teaching your learners?

Interviewee: Ja.

Interviewer: To delivering your subject matter?

Interviewee: Ja, though not frequent, I use it for my personal reasons for typing my own tests to eliminate the procedure, the mistakes that the clerks always do for, for research purposes and, but to interact it with my teaching and learning, it is very rare. I only use it now and then.

Interviewer: For your personal things?

A: For the learners to integrate. But personally I use it, I can say full time.

Interviewer: Do all teachers at your school use integrate ICTs in their teaching activities?

Interviewee: No, not all but a few, I know three of my colleagues whom I also interact with they do.

Interviewer: So they also use the ICTs for teaching the learners?

Interviewee: Yes, there is one in English, who usually brings DVDs as well and plays them to her learners and there is one Maths Literacy teacher who does that most of the time. Ja, but its only a few.

Interviewer: Okay, why are these other teachers no interested in using ICTs?

Interviewee: They still according to the way I think, they still think computers are associated with administrators. So they feel that if they can may be type their own tests, do they own stuff on the computer, then clerks will be lingering around not doing anything. So it is just an attitude I think. Some, especially from where I am working, since most of them are approaching pension, they are saying there is no need, they are exiting the system anyway, so ja.

Interviewer: Okay that could be a reason.

Interviewee: Mm

Interviewer: Okay, then do you have all the necessary applications software, such as the word processor, database etc. required for the facilitation of teaching and learning?

Interviewee: Not at school, but in my own laptop, I always buy these and load them on my laptop but my Natural Science facilitator, at least one, she is hands on, she always communicates with us via e-mail. So she always e-mail us stuff to use in class, so ja, at least in NS we are more advanced through the facilitator.

Interviewer: But there is some software that are not available.

Interviewee: Ja. Most are not.

Interviewer: Okay. So do you use these ICT programmes in teaching a subject?

Interviewee: Ja, sometimes, though, I do, but sometimes not often.

Interviewer: Okay.

Interviewee: The problem is we move around, learners sit in class, we move around, so it becomes a bit difficult to always move around with stuff since there is a lot of learners and our computer lab is so small, it can only accommodate 30 learners and we have around 55 learners in a class, so can you imagine controlling their behaviour in the lab. It is going to be difficult. It is going to be time consuming as well. So that is why I only choose a topic where I present it, I take may be two classes into the library, asking for periods from other teachers and then present it. The next period take the other two, just like that.

Interviewer: So you use the library instead of the laboratory?

Interviewee: Yes.

Interviewer: Okay, and then, if not all teachers use ICT for delivering their subjects, in which subjects are ICT used for the facilitation for teaching and learning.

Interviewee: It is NS, Maths and they usually use it and there is English as well.

Interviewer: In these three subjects?

Interviewee: yes.

Interviewer: Does the use of ICT proved to be a better method of teaching learners as compared to the traditional methods of teaching?

Interviewee: Of course, it enhances their concentration, I mean, kids love technology, so if you bring something technology related, obviously we've got their attention, they will concentrate, they get excited and they never forget what they've seen rather than you standing in front of them reading written text, so I think it is very effective.

Interviewer: Okay. Then do learners learn better as a result of using ICTs?

Interviewee: Yes, though we don't use it often enough but confident, the chapters that I introduce using videos and questionnaires that I distribute after they've seen the video, most of them answer correctly, rather when than when I present it or I lead, there is a difference.

Interviewer: Okay. What difference, if any has ICT made to your learners' performance?

Interviewee: I think it, as I said earlier, it improves their level of concentration and it makes them keen to learn that learning area excited to see more videos, because every time I show

them a video clip, they always ask when are we going to another one. So it improves their performance.

Interviewer: Then how do you use ICT to cater for learners' learning needs? You know we have different learners in a class, we have those who are very smart, we are those who are struggling, how do you cater for such children?

Interviewee: Fortunately I do not, I just, it's just a standard thing, unfortunately we don't cater for those slow ones. But I don't play it once and then explain, I just play it and let them explore afterwards, then I explain what they should be looking for out of that video, play it again and allow them to take a few notes. Most can see what is going on, but to the slow learners it is a bit difficult, because of time I cannot accommodate them.

Interviewer: In other words, are you telling that me you set the goals, you have the objectives for that particular lesson, and if then if they have achieved the goals, then you are satisfied?

Interviewee: Yes.

Interviewer: If you see if some still struggling, then you may repeat the lesson, or you play the whatever.

Interviewee: I play over and over but though not often enough.

Interviewer: Okay. Then do you use the computer and the internet to update your subject knowledge?

Interviewee: Yes, I always do. The Department of Basic Education has several web sites and I like the Thutong one, it's got lots of templates of different things lesson plans, activities, especially for practical work and they've got previous exam papers, so ja, I use it a lot.

Interviewer: Do you use the internet to update your professional development?

Interviewee: Yes, in terms of may be, especially after the CAPS workshop, since it was only four days and some of the content I didn't master well, so it is always easier to look at the simplified versions on the Education website. That's how I go.

Interviewer: Then do you give learners tasks which prompt the use of the internet.

Interviewee: Yes I do, though not all of them have access to the internet, but most do, because of the University of Pretoria, the Mamelodi branches introduced a library, they, learners go there, enroll for free, they give them access cards and then they go there after school, it is open from 2 until 6 o'clock. So most of our learners, in my class I've got 48 learners and I think 35 already use that. Recently Tshwane free Wi-Fi is available in our

township and learners can access internet for any information they want. Many learners use the internet, even when I didn't give them work to go and research, after I've done a chapter, some bring in handouts that they have printed there, so they go there and read more about that, print out information and stuff.

Interviewer: So they are very active.

Interviewee: Ja, they are.

Interviewer: What are the positive or negative outcomes for you as the teacher?

Interviewee: You mean terms of ICT integration?

Interviewer: Yes

Interviewee: The positive is it makes my work very easy. The negative is I wish all learners had access. I wish that lab was functional because I mean it is a waste of room, a waste of space, equipment. And while it is not functional, so I wish, I don't know someone will come and upgrade the software and stuff so that learners can have access to that, especially learners in grade 11 and 12. So that they can access to the internet, check for careers, because most of them after matric they just sit at home and the only reason it is because they don't know what to study. So have they had the access to internet, it would have been easier, they would have an idea what to do.

Interviewer: Okay. As digital age children, the majority of the learners in urban and rural areas do have smart phones. Do you allow them to use their smart phones for learning?

Interviewee: No, not in my case. I have never thought of that, because with our school, we've got learners who, I can say the majority of our learners are from the squatter camp, so I think some would feel discriminated because I don't think in a third of my class have got those smart phones, they just have basic phones and can receive or make calls.

Interviewer: Then do you regard using ICTs as having any benefits? Or is there a benefit for using, to using ICT in teaching and learning, like the benefits of ICTs?

Interviewee: Ja, I think if we use it more often, some learners, grasp knowledge through visual, through vision, to if they see something, it would be easier, and besides it would be a computer lab it is a very different environment and an exciting one as well. So ja, it would have more benefits to the learners and to the teaching and learning in general.

Interviewer: Okay. Can you say something about the, you know, something about learners learning motivation, interest, does the use of ICT arouse interest?

Interviewee: Yes it does, I think it boost their self-confidence as well, it is every child's dream to be able, to be computer literate and if you expose them to such facilities, it will boost their self-esteem and they would view learning as exiting.

Interviewer: Okay. Then taking globalisation, the qualities required for the 21st Century, the knowledge, society, social and economic development into consideration. Do you see your role as a teacher being the same as before?

Interviewee: No, not at all because I mean I won't be, even now as we had, all the teachers were able to use ICT facilities and stuff. We would be very different and we would be more advanced in our subject areas as well we would research more, find out more information and stuff. And communication as well will be easier, like in my case, we share stuff, tasks, a DVDs with other teachers, whom I've met at cluster meetings, road shows, and we always share things via e-mail. So if all teachers did that, it would have a very good impact on teaching and learning.

Interviewer: But do you see yourself as a facilitator or the teacher who has to deliver information from yourself to the learners, like imparting the knowledge to the learners, or do you see yourself as facilitator where you engage all learners to do activities on their own?

Interviewee: With the, I see myself as a teacher, just imparting knowledge, most of the time, I am only facilitating every once in a while and I think it is because of the logistics, obviously, timetable, I mean in a 30 minutes period of you cannot always interact them, you can only do it every once in a while and then even group work, group and pair word, it is, I don't often use that because of the logistics, they are over-crowded and it consumes time as well.

Interviewer: Okay. Why do you feel it is necessary to use ICTs in teaching today's generation?

Interviewee: Obviously everything is technologically related. I can quote my experience at the varsity, most of, it is just that I was I took a gap after matric; I didn't go and study, just did short courses in computer literacy and then advanced one for a year. Then the following year I went to tertiary and most of my peers didn't know how to use the computer, let alone to switch it on. They were like, they had this phobia, scared of it, I mean if our learners, especially in the townships, don't know how to use computers, it is going to be difficult for them, at tertiary. These days when you send an assignment you have to type it and e-mail it.

If you are computer literate it is easy to do it yourself instead of spending money asking someone to do it for you. So I think it is a necessary skill for learners to acquire.

Interviewer: Okay. Then the South African Education Policy states that all African learners must be ICT capable by 2025. Do you share the same vision with the policy makers and the department of education?

Interviewee: Ja, I do, I agree with it. I think it is a necessity because, hey everything uses computers, as I said at the High school, the won't see the importance of it, but as they grow up, everything is related to that and it makes life very easy, for example, when they are grown and working, instead of queuing on ATMs withdrawing a lot of money to pay their bills, they can do it via internet banking and just transfer money and it will make their lives easy.

Interviewer: What is your opinion on the policy statement which says that all South African learners must be ICT capable by 2025?

Interviewee: I don't think so, especially if it is introduced by the Department of Education. As I told you earlier about the Gauteng on-line, ever since it was introduced it has never worked, their contract has even expired without it being beneficial to the learners. So I don't see their vision being real or realised.

Interviewer: Then what challenges do you encounter in integrating ICTs in your teaching responsibilities?

Interviewee: Integrating it in class?

Interviewer: At school level and personal level.

Interviewee: Well at personal level I don't have any challenges by introducing it in teaching and learning it is difficult as I told you there is, the computers that we have, are not working. So even if, the only way I can integrate it, it is only by bringing video clips and letting learners see it, but them accessing them the computer, typing, researching on their own, it is difficult, only those who've got access to the library at UP, like around the school, Oh, it is difficult, because we don't have computers that they can access.

Interviewer: What other factors are seen as challenges by other teachers?

Interviewee: As I told you earlier, since they've got a negative attitude toward computers, so the worse challenge is that they do not want to involve themselves in ICT related materials, so I don't think, as the question earlier said, implementation of the ICT by 2025, I don't know how they will go about it, but if they can remove that negative attitude in

teachers and somehow motivate them and encourage them to use ICT material more often, may be, but as of now, it is difficult, you don't, they don't want to type, use those computers, for instance in our school, all HODs have computers in their offices, but only a few use them. So, they just lock them in the strong room, some they spend even more than a week without taking them out of that strong room and using. So even the SGBs trying to give them access to computers, they just don't want to use it.

Interviewer: So it is because of the negative attitude. Then what about the time, time constraints.

Interviewee: We've got free periods and there is no one who doesn't have the free period. I don't think time has got anything to do with it. They all have time. Even in the afternoon, you can sit around, for at least for 30 minutes use it to research more and find out more. So stressing because they don't want to use it yet, if you are computer literate they will always ask you to search this and that for them, download previous question papers and stuff and it is becoming tiring and irritating to do stuff for them while they've got the ability to learn that.

Interviewer: Okay. Then what can you say about the parents? Are parents supportive?

Interviewee: Yes they are, because they allow their kids to go to UP after school, and knock of at five. All those kids who got cards, I never experience any parent complaining about their learners (children), coming home later or anything. I think they are supportive, because they even give them extra lunch so that they can survive longer hours there at the varsity.

Interviewer: Okay. And you know as we are staying in the township, don't you have the burglary problem?

Interviewee: We did, but now no the computers which we brought in by the Department of Education are well secured.   So never ever experience that.

Interviewer: So what changes are needed for maximal use of ICT in teaching and learning?

Interviewee: The first one, is to introduce a computer related subject, even if it is non-computer applications, technology, may be for lower levels, grade 8 and 9, just a computer practice period, or something, then it would have an impact.

Interviewer: Okay.

Interviewee: Starting from the timetable.

Interviewer: Okay, on the part of the teachers? What is it that can be done in order to ensure that all of them use ICTs in their teaching activities? What measures can be introduced?

Interviewee: May be as the like, like the Department of Education is now doing things, documents, communication between schools and the Department is via e-mail. I think on the teachers' level, maybe facilitators do that as well. Maybe, I don't know for moderation, all teachers must be told that they must scan files, learners' files and e-mail them, I don't know, it might have a positive impact on that. Because I mean one cannot scan files for ten teachers, they will be forced to know how to scan documents and e-mail them. Ja, maybe if the Education Department could encourage communication that way, even down to teachers' level. May be it might work.

Interviewer: So in other words they can come up with ICT policy?

Interviewee: Ja.

Interviewer: We've come to the end of our interview and thank you so much for participating in this interview.

Interviewee: You are welcome

PRINCIPAL #1

Interviewer: Good afternoon, I am Shirley Mukhari from the University of South Africa and I am currently undertaking research studies on the teachers' experience on ICT usage in urban schools. This interview is conducted to seek and gather information pertaining to teachers and principals' experience on the use of the ICTs in teaching and learning. The purpose of this interview is to determine the use of ICT for teaching and learning with the focus being on teachers as key figures in the teaching and learning environment. I have chosen you to participate in this interview firstly because you are the school principal, and secondly because your school has ICT infrastructure for teaching and learning. I will not use your name to ensure anonymity. What you say will be kept in confidence. I encourage you to answer all questions as this will help me to gain a better understanding of what I am researching. Remember that you are not under any obligation to take part in this exercise and in order to continue with this interview, I need your consent to proceed. One other thing is that if you don't wish to continue, you can stop as you wish. I am going to refer to you as Principal #1, so do you accept to go on and allow me to conduct the interview?

Interviewee: Yes Ma'am.

Interviewer: Okay. Thank you very much. In this interview your identity will not be revealed it will be anonymous and secondly whatever you say will be confidential and thirdly I am going to record you and will you accept that?

Interviewee: Ja, I have no problem with that.

Interviewer: Okay, thank you very much. In this interview you are allowed to go on but if you decide to quit or to stop you are allowed to do that. You are no under any obligation

Can we go on?

Interviewee: Yes you can on.

Interviewer: Thank you very much. We are starting with your gender? We want to know if you are a male or female?

Interviewee: I am a male.

Interviewer: And what are your qualifications?

Interviewee: My qualifications, I've got a BEd Honours and Education Management and Policy.

Interviewer: And the name of your school?

Interviewee: The name of my school is XXXXXXX High School.

Interviewer: For how long have you been a principal?

Interviewee: Five years.

Interviewer: Thank you very much. For this interview I will refer to you as Principal No 1. As the principal of this school, what is your vision on the use of ICTs in teaching and learning?

Interviewee: The use of ICT in teaching and learning is, I am that is the way to go, I mean the Department is over-ruling the chalk and talk, we are getting to the world of technology. That is our vision, our school so far has got a computer lab in line with our vision to enhance, the teaching and learning. Using a computer is better because learners can see the pictures, it is audio at the same time, it is visual. Unlike in the olden days.

Interviewer: Does you school have the necessary ICT equipment for the facilitation of teaching and learning?

Interviewee: In the line of ICT.

Interviewer: Yes.

Interviewee: Yes, we do have a computer lab, we also do have an I-box lab, where we are using the projectors, using the computers, yes we have facilities there is a lot of enthusiasm among the teachers and learners.

Interviewer: And they are both used for use for teaching and learning?

Interviewee: They both use for teaching and learning on a daily basis.

Interviewer: Okay. The National Education Policy on ICT, maintains that every South African learner must be ICT capable by 2025. How do you as a principal enforce this policy?

Interviewee: It is still difficult to enforce this policy because as you can see ma'am, the computers, the number of computers, the ratio of computer per learners, I have got a role of 1300 learners and then only 25 computers in the school. That means, it happens that a child, one child can use computer may be once a week. Or sometimes even after three weeks. So it is not feasible for now unless you know we had bigger computer lab for each and every class, like in America, have such facilities. It would be possible for learners to access those things as one on one or even one to three it was better. But now the ratio is too small. I mean 1300 learners for 25 computers, it is not sufficient and sometimes we do have problems of network not working and then whereby you find the computers are not working for a month or two.

Interviewer: Then do all teachers use ICTs in their daily teaching activities?

Interviewee: Not as yet, just a selected few who are computer literate, but you know the training is there but you on a minor scale in my school for instance there are, the number of teachers who are getting into computers are increasing but at a very slow pace.

Interviewer: Okay. And for which subjects are they using the computers?

Interviewee: They are using the computers for Maths and English, because in Maths learners cannot add, they cannot subtract, you know these little things, so for Maths actually, it is what our computer lab is focused on. And also English as a communication language.

Interviewer: But do you wish to integrate ICTs in all the subjects that are being taught at your school.

Interviewee: That is an ideal situation. I would to like have that if it was possible.

Interviewer: Okay. Then do all teachers use ICTs in their administrative tasks?

Interviewee: Not all. Just may be a quarter of them. Yes they use ICT for instance in our staff room, we have donation of about three computers donated by I think it is Vodacom, whereby you know, teachers can now prepare their lessons, they can access various topics on the computer and internet. Yes, it is, I mean as these teachers are busy doing that and then their workload becomes less, even less and other teachers follow suit.

Interviewer: Yes. Okay. What changes have been noticed as a result of using ICTs at your school?

Interviewee: The changes are huge ma'am because of, for now, unlike in the past, for now I see if I look at the statistics of my teachers, last year alone there was one guy who was selling computers, he was a white guy. I think the prices were reasonable, that now every teacher has a laptop. And then you can see they are enjoying their, their workload is very easy.

Interviewer: Okay, so do they bring their laptops to school?

Interviewee: Yes they bring their laptops to school. Yes.

Interviewer: Okay, is teaching and learning improving as a result of using ICTs at your school?

Interviewee: A lot ma'am, it is improving because you know the recent, I don't know, I've got no vocabulary for accessories, but most of the accessories that are there, are able to cover a big scope, they can give tests and mark this, these computers can give tests and

mark at the same, in a period of 35 minutes, a teacher has covered his work, has tested the learners, the learners have answered and at the same time get feedback.

Interviewer: Okay, that we call educational software or application software.

Interviewee: Now thank you very much.

Interviewer: Okay. Then what factors inhibit ICT usage at your school?

Interviewee: Inhibit the, by the way can you help me out there?

Interviewer: What challenges do teachers experience in the use of ICTs at your school?

Interviewee: The challenges I have already mentioned, sometimes you find that there is no internet for quite some time and then some other teachers may be those who are more advanced, and then you find that they use the computers, may be in the evenings, like the internet, gets finished. Sometimes, you know the biggest challenge that we have, in our schools, is how to monitor the learners because you find that watching programmes which are not educational related, like pornographies and other things, so if these things are not monitored, they can be abused.

Interviewer: Okay. One other thing, what is your opinion about the parental involvement?

Interviewee: In as far as computers as concerned?

Interviewer: Yes.

Interviewee: Parental involvement is a very big issue. Our parents are loafing in most cases, even in normal day to day to teaching without computers, we have to immobilise them into coming to our schools and all those things. The use of technology, you know they become excited about that, when a parent knows that my child is computer literate, the parent becomes very excited, but the computer itself to our black learners is remote.

Interviewer: Mm

Interviewee: Ja, it is an unfamiliar situation. You know it is like, it is magic to them.

Interviewer: And what about those teachers who are not interested in using the computers?

Interviewee: I haven't seen teachers who are not interested, the only problem that I have noticed is lack of skills. Yes. I mean they sigh by all major developments I've seen. We have what we call a programme of IQMS which demands that teachers should develop themselves, so in most cases for people to be well developed and then they tried, this is one of things they are getting into. They all want to be computer literate.

Interviewer: As your school is in the township, do you have some problems with people from outside who come into the school here, without the permission, or those who vandalise the buildings and you know break into the school?

Interviewee: Not as yet, in the past, we used to have such incidents, and I hear about such cases but not at my school, because at our school the computer lab is well protected. We have involved the service provider like Chubb and like ADT even computer on-line itself has engaged the services of those people of which have alarms systems in our schools. So even our children know that that is a no go area. Once you or touch of go next to that thing, even the wind that blows sometimes, the alarms goes off and there are the security people. So you will understand that most of the crimes are not done necessarily by the people for outside, are done by the very same learners that you are teaching.

Interviewer: Okay. What is your school policy in terms of ITC integration in teaching and learning at your school?

Interviewee: Ma'am I want to be honest with you, we haven't as yet established a policy on ICT, although the government from our workshop last week, hinted that you know, we should try and develop a school policy, but now problem with that is that if each and every school has to develop his own policy then you might find that we've got 100 different policies, each school with its own policy, which policy won't be uniform.

Interviewer: Okay. ICTs across the curriculum or are they employed in some subjects?

Interviewee: They are employed in some subjects, like I've said, in English and Mathematics and Science, Physical Science.

Interviewer: Okay, thank you. How do you engage parents and the private sector in ensuring that ICTs are well integrated in teaching and learning at your school?

Interviewee: Private sectors, I do not have any idea, because you know, this computers for now, since they were installed by Gauteng Online, it is very difficult to get other agencies to come into play ,because once there is something there, these things are ensured and means the Gauteng online will have a problem with that. You might even lose the rights of using their computers. If there is any usage or faults whatever, Gauteng online wants to be the only and the sole people who are involved with their facilities.

Interviewer: What measures can you introduce to ensure that your teachers and learners comply with the 21st Century requirement and the policy of the National Department of Education on eLearning and ICTs in education?

Interviewee: Ja, ma'am what we have started as a school, like last year, we, during holidays we had a session whereby all those educators who are experts in the use of these computers, were training the rest of the staff members, for free. They came to those workshops, they were our own internal workshops, whereby we were training each other, and since then everybody is able to use a computer, although on a minor scale.

Interviewer: Okay, and what about the 21st Century requirements?

Interviewee: The 21st Century requirements, I don't know if we are going to achieve that, because at the moment the Gauteng online has suspended its contract with the Department of education, meaning now our centre is becoming a white elephant. If it becomes a white elephant, now what the department does, they went to another, a different service provider who can supply schools with tablets. And what is happening now, each school for now is getting 40 tablets, 40 tablets it means two out of 40 will be used by educators, 38 will be used by learners, and then the possibility of this, these tablets to be abused is so great, to be stolen as well, some schools don't have storages, you know, it will be very difficult because they are movable, unlike the computers which were mounted.

Interviewer: Okay. Then what do you recommend in terms of bridging the gap in the ability of learners and teachers to use ICTs in teaching and learning?

Interviewee: It is, bridging the gap is a little bit problematic, like they say, a teacher is always a lifelong learner. You find nowadays the learner is more advanced than the teacher when it comes to the computer, as a result you know, the cell phones, our kids are used to cell phones, they are more advanced than most of us now. I think we are lacking behind ourselves as educators s and we need more workshops.

Interviewer: Okay.

Interviewee: To be organised.

Interviewer: One other thing. What about the role of the Department. What is it that you recommend that the department should do in terms of bridging this gap?

Interviewee: The department is trying, there is a lady in the Department, by the name of Shadi, this lady is trying all the business she can to link our schools with Vodacom where our teachers are being trained, so far for the past two years, only two teachers were going there, for some training and with the hope that those teachers will come and train the rest of the teachers. The pace we are going is very slow. The pace is very slow. I mean if we have to a session whereby we develop the teachers in class, it means this thing must be

included in our timetables, so as long as   these   sessions, the developmental stages, is not included in our timetables, after school teachers are already tired, they want to rush home, there is no time for them to come and do these things and there are too many workshops, which are disturbing this thing, the computer problem, because these workshops, teachers are focusing now on what we call CAPS the change in syllabi which they are not familiar as well. So there are too many things which are new to them and it becomes very difficult for a teacher to cope with this kind of changes.

Interviewer: Okay. But in any case you recommend that may be the department or the school SMT should organise some workshops.

Interviewee: Workshops. Ja, workshops will be very ideal. One problematic thing is that most of the schools in the township, I think as may be you are aware, are monthly paying school, so as a result there is nothing extra that you can do because the school does have not have. If organise a workshop, sometimes refreshments for these people, it needs, this and that. It is terrible.

Interviewer: Okay. Now we've come to the end of our interview. Thank you very much principal #1. One other thing I promise that I will really come back to give you the feedback. Thank you once more for your participation in this study.

Interviewee: Thank you very much Ma'am Mukhari. It was a pleasure.

APPENDIX L: RESEARCHER'S JOURNAL ON NON-PARTICIPANT OBSERVATION

School A:

- Interview conducted after school hours and later concluded at the participant's place as the participant had other commitments.
- DBE ICT laboratory with 25 computers and the lab was seen from outside.
- ICT laboratories: Locked and it appeared as if the laboratory was seldom used or not used at all.
- The teacher participant requested that the recorder be switched off on questions about the school leadership.
- The impression that the researcher got was that there was a conflict between the teacher and the principal/ SMT.
- Other responses were recorded.

School B:

- The school had a media centre and a computer laboratory
- The media centre and the computer laboratory were also used for keeping other things. Despite that the computer lab was used by the teacher who participated in the study.
- The participant also requested not to be recorded in other instances.
- It became clear that there were some information which they did not want the researcher to know however, due to the confidentiality ethics, they opened up.
- The participant mentioned facts which were perceived as weak points about the SMT.

School C:

- Two computer laboratories and an enthusiastic teacher on using ICTs in teaching and learning.
- Learners use the laboratories during break and after school.
- The school had a satellite for conferencing with other schools but it no longer works due to financial problems.

School D:

- The school has a computer laboratory with 25 computers.
- The teacher was the only one in charge of the laboratory.
- Learners are using the computers in the participant's subjects and no other teacher frequents the computer centre.
- Other teachers seemed not to care about what happens in the centre.
- Teacher and the principal are the only two persons who seem to use ICTs in their communication with the District Office.

School E:

- One computer lab with 25 computers. Learners spent break in the computer laboratory.
- The school had a white board, projector, and a TV set which was stolen by thieves and was never replaced due to lack of money or the fear that the thieves may come for the new TV again.
- A young teacher who feels good about the ICT in teaching and learning.

School F:

- Two computer laboratories and many other teachers have laptops and smart phones
- Principal was not so sure about the number of computers but was confident that the teachers were using the computer laboratories effectively.
- Very enthusiastic about the use of computers, the internet and emails in developing both teachers and learners.
- Complained about lack of funds for other things related to computers but does manage to do small projects.
- The private sector plays a role in managing the 2nd computer laboratory.

School G:

- An old IBM building with 25 computers.
- The building had cracked walls and was locked.

- Other teachers did not answer questions on what should be done to ensure that the computer laboratory worked for themselves and the learners.
- Principal seemed not to know anything about the computers and blamed DBE for the dilapidated nature of the laboratory.

School H:

- One computer laboratory with 25 computers.
- The laboratory is not functional as it is always locked most of the time.
- Older teachers do not engage in using ICTs.
- Teacher uses DVDs for teaching and learning purposes.

School I:

- Modern school buildings and a GoL computer laboratory and internet connectivity.
- The school is in informal settlement there was a high enrolment of learners.
- Teachers do not use computers for teaching and learning but the facilities are used for administrative purposes.
- Language software and other educational software were available but teachers did not know how to use them.
- Principal about to retire and seemed not to care and maintained that the next principal will see what to do with the laboratory.
- Many teachers in the school had been deployed to the new school and most of them are about to retire.

School J:

- Two computer laboratories with about 55 computers.
- Most teachers have smart cellular phones but a few have laptops for their personal use.
- Principal seemed not to know about what is happening in the laboratory
- Very enthusiastic about the use of computers, the internet and emails in developing both teachers and learners.

- Complained about lack of funds for other things related to computers but does manage to do small projects.
- The second lab was donated by a private company through the initiative of one of the parents who works for the company.