LIST OF ACRONYMS

ACEPS:	Advanced Certificate in Education Physical Science
AD.IT:	Advanced Diploma in Information Technology
APO:	Area Project Office
BMI:	Body Mass Index
BSc.IT:	Bachelor of Science in Information Technology
BTech IT:	Bachelor of Technology in Information Technology
CA:	Computer Application
CAPS:	Curriculum Assessment Policy Statement
CAT:	Computer Application Technology
CK:	Content Knowledge
DBE:	Department of Basic Education
DoE:	Department of Education
DVD:	Digital video disc
ELRC:	Education Labour Relation Council
FET:	Further Education and Training
GET:	General Education and Training
GIS:	Geographical Information Systems
GP:	Gauteng Province

GPS:	Geographical Positioning System
HET:	Higher Education and Training
HOD:	Head of Department
ICT:	Information Communication Technology
ICTs:	Information Communication Technologies
IT:	Information Technology
LAIP:	Learner Attainment Improvement Plan
LAN:	Local Area Network
LCD:	Liquid Crystal Display
LO:	Life Orientation
MIP:	Multimedia Integration Program
NCS:	National Curriculum Statement
NEPAD:	New Partnership for Africa's Development
NWP:	North West province
OBE:	Outcomes-Based Education
PCK:	Pedagogical Content Knowledge
PK:	Pedagogical Knowledge
RNCS:	Revised National Curriculum Statement
SA:	South Africa
SMT:	School Management Team

TCK:	Technological Content Knowledge
TK:	Technological Knowledge
TLI:	Teacher Laptop Initiative
TPK:	Technological Pedagogical Knowledge
TPACK:	Technological Pedagogical and Content Knowledge
UNESCO:	United Nations Educational Scientific and Cultural Organisation
UNISA:	University of South Africa
USA:	United States of America

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CHAPTER ONE
INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This chapter examines the use of Information Communication Technologies (ICTs) worldwide. It also embraces ICT usage in developed and developing countries, focusing on South Africa as a developing country and the United States of America (USA) as developed countries. The problem statement is discussed as an indication of what prompted me as the researcher to conduct this study. The chapter further highlights a motivation for this study and discusses its significance. The research design is essential in this chapter as it specifies the approach that I employed to investigate secondary-school teachers' ICT competencies. Also included, are the main research question and sub-questions, the aim and objectives, a preliminary literature review, how this study was framed, ethical considerations, measures to ensure trustworthiness, ICT competencies, the plan of the study and a definition of terms. Finally, the conclusion provides a summary of the entire chapter.

1.2 THE USE OF ICTs WORLDWIDE

In this study, the terms 'Information Communication Technology' (ICT) and 'Computer Integration' were interchangeably used because the computer is regarded as a technological tool which belongs to the ICT category (Department of Education, 2004:15; ICT in Education, n.d.:1). The term ICT is used to encompass all technological devices used to enhance teaching and learning; therefore, computers as technological hardware also play a pivotal role in this study.

A teacher leads the way in being resourceful in the teaching and learning situation. In this information age, with so much exposure to the technological environment, it can be even better to augment the facilitation of what learners are expected to learn by integrating ICTs. The attraction of the use of technology, computers in this case, is so widespread (Evans, Martin & Poatsy, 2010:3; Wang, 2006:35) that it is hugely

limiting for one to function without it. The world today is continuously influenced by ever changing technology. As a result, the use of ICT is constantly changing the way people work and, more significantly, is changing performance and production for the better (Mbangwana, 2008:2; Ministerial Council on Education, Employment, Training, and Youth Affair, 2005:115). People interact with ICTs daily and are sometimes even unaware of its infusion in everyday life.

The advancement of technology has brought new knowledge and modern applications that give rise to constant transformation in society's culture, and social, political and educational environments (Angeli & Valanides, 2009:154). Hence transformation in these sectors obliges the 21st-century society to change its mindset in order to adapt to new technological developments. Angeli and Valanides (2009:154) and Kwache (2007:398) support this idea; they point out that the 21st-century society is required to think critically, solve problems, collaborate, communicate with others, use various technologies, take initiatives, and bring diverse perspectives into the learning environment. Furthermore, the 21st- century is characterised by an irresistible mass of information and, more significantly, has seen dramatic changes in the education fraternity across the globe. Hence, the educational context as a branch of human knowledge compared to all other sectors needs to be redesigned in order to be on par with new developments brought about by this information age (Ololube, 2006:101).

The new skills are now required and are certainly driven by this information explosion. But the gap that this study has identified is that, for most teachers, there is some degree of computer illiteracy, so that they are unable to integrate technology into teaching and learning. This might be compounded by the under-resourced circumstances of some schools in regard to ICT infrastructure. In a school environment, teachers can involve learners to do hands-on technology through the use of computers and other related ICTs like internet to learn effectively. ICT's remarkable penetration in education is inevitable and teachers are faced with the challenge of being competent ICT users (Mills & Roblyer, 2006:6). They hardly have a choice but to explore and embark on the opportunities provided by the use of technologies.

Certainly, to make best use of ICTs teachers must be equipped with adequate ICT competencies (Goktas, Yildirim, & Yildirim, 2009:276). In other words, teachers must possess a solid professional background with regard to the use of ICTs. They are the cornerstones for curriculum change and are expected to embrace this educational paradigmatic shift as comfortable as possible (Watson & Reigeluth, 2008:42).

Lack of deep ICT knowledge for teachers has raised concerns within the education system. Research has shown evidence that efforts have been taken to train teachers in the use of ICTs, but the majority of teachers are still not yet familiar with their use (Baron, n.d:26; Angeli & Valanides, 2009:155). This would be a challenging paradox if teachers were not competent ICT users. In the first place, if they have to effectively integrate computers in their classroom practices, they are obviously expected to acquire ICT competencies. They then have to practice what they have acquired.

Desjardins, Lacasse and Belair (n.d.:214) and Baron (n.d.:25) in their studies distinguish four types of ICT competencies, namely technical, informational, social and epistemological. Other authors, such as Goktas et al. (2009:277), refer to them as ICT knowledge, skills and attitude. Desjardins et al. (n.d.:214) describe these competencies in the following manner: “The technical competency involves the basic operation of computers, which is knowledge of computers and how to use them. Information competency entails teachers’ ability to draw relevant information or surf a variety of search engines available on the internet. Epistemological competence involves capitalising on the use of technology to solve a problem, or to rely on what technology can do to treat information in a variety of ways. Social competence is the ability to interact and communicate with global communities through the use of ICT’’. These ICT skills are detailed in the literature review provided in Chapter Three of this study.

Trucano (2005:1) emphasises that integrating computers in teaching and learning not only transforms teachers’ pedagogical practices but also improves learners’ ICT interaction. This has got to do with 21st-century learners who are fascinated by the use of technology. They are called a net generation or digital natives (United Nations Educational Scientific and Cultural Organisation, hereafter UNESCO, 2010:11). They

tend to interact with ICT more often to learn its usage and take full advantage of its potential (Desjardins et al., n.d.:212). Surprisingly, they can watch television, listen to their ipods, send text messages through cell phones or ipads, and work online simultaneously (Anderson, 2010:20). Moreover, as they chat with peers online or through sms, they use a short-hand language that they have created, for example HRU for how are you, CU2MOROW for see you tomorrow. This is just the beginning of realising how technology has quickly changed learners' mindset to be creative and multitasked. Apparently, teachers can be bewildered by this generation's ICT knowledge and be threatened to teach them if they are not competent ICT users themselves.

For Goktas et al. (2009:277), competency is the state or quality of being well qualified to perform a task. However, most teachers might not be qualified to facilitate a technologically integrated lesson. In essence, their qualifications do not include training in integrating ICT in teaching and learning (Tropakci, n.d.:1; Afshari, Bakar, Luan, Samah & Fooi, 2009:89). Tropakci and Afshari et al. further contend that most teachers have only received computer literacy skill in their pre-service training and are not trained on information and integration literacy skills. Prospective teachers equipped with one of these ICT skills would be less developed and would be unable to facilitate a technology-integrated lesson. The three ICT skills would enable teachers to transform education system and they would also be on par with new technological developments. Angeli and Valanides (2009:154) assert that "technology has the potentialities to transform the teaching and learning when it is appropriately used". This implies that the acquisition of three ICT skills can enable teachers to choose an appropriate technological tool for the achievement of the lesson outcomes and the assessment standard.

While the above developments about integrating technology to enhance teaching and learning are appreciated and relevant to the postmodern era, what motivated me to conduct this study was that in some institutions there has been almost no computer integration in teaching and learning at all. This is a crucial misfit in terms of the 21st-century expectations. Twenty-first-century learners are multitasked; hence

they need to be taken out of four classroom walls through the use of technology in order to experience a real-life situation.

For Pearlman (2009:15), teachers have a hard time envisioning and conceptualising the true 21st-century education. This problem is made even more complex by the challenges brought by technology. According to Magana and Frenkel (2009:1), teachers need to be technologically empowered so that they can successfully teach the 21st-century content in the 21st-century context using 21st-century tools. Simply put, Magana and Frenkel say that teachers need to be equipped with ICT skills so that they are able to expose learners to the use of a technological tool which tallies their real-life situation.

A significant body of ICT research studies has focused on the training of teachers in the use of ICT in different subjects (Cajilig, 2009:80). The training of teachers on how to integrate ICTs in teaching and learning has been an essential step pursued by different countries because integration of ICT in teaching and learning requires teachers to be competent ICT users. Unfortunately, the training offered did not show whether ICT competency was part of the proficiency acquired by teachers. In the studies conducted by Afshari et al. (2010:8); Goktas et al. (2009:277); and Angeli and Valanides (2009:155), they collectively cited that there was no clear indication that the training of prospective teachers assists them to acquire the essential ICT competencies; In the South African context, little has been done in terms of conducting research on teachers' ICT competencies. I therefore attempted to bridge the gap, as this study sought to investigate secondary-school teachers' ICT competencies as manifested in their classroom practices. The discussion below details teachers' ICT competencies in the developed versus the developing countries.

1.3 PROBLEM CONTEXT

1.3.1 Teachers' ICT competencies in developed countries

Internationally, there is an increased realisation that the integration of ICT in education better prepares learners for 21st-century skills (Blignaut, Hinostroza, Els &

Brun, 2010:89; Baskin & Williams, 2006:14). The United states of America formulated the national organisation known as The Partnership for 21st Century Skills in 2002. This organisation initiated a framework for 21st-century learning which advocated skills, knowledge and expertise that learners should acquire for a successful life. From the onset the organisation provided the United States of America with technology tools and resources that assisted teachers in the development of learners' 21st-century skills. The overall goal for transforming the education system is to produce learners who are equipped with ICT knowledge, skills and expertise for post-secondary education, employable and would efficiently and effectively contribute in a competitive global economy (Shelly, Gunter & Gunter, 2010:14; Partnership for 21st Century Skills, 2009:1).

To drive progress, the organisation convened a forum which included academics, state business leaders, education leaders, and policy makers to come on common grounds concerning a powerful strategy that would pave the way for learners to achieve successful 21st-century work related ideas. This organisation's venture encouraged states abroad to infuse technology into their education systems. The United States of America that endorsed this framework included West Virginia, Wisconsin South Dakota, Ohio, North Carolina, Nevada, Massachusetts, Louisiana, Kentucky, Kansas, Iowa, New Jersey, Arizona and Illinois (Twenty first century states, 2007:1). Each State designed a strategy suitable to promote 21st-century skills which, according to Shelly et al. (2010:14), Magana and Frenkel (2009:1), and Partnership for 21st Century Skills (2009:1), are critical thinking, problem solving, communication, and collaboration, creativity and innovation (known as 3Rs and 4Cs). Most notably, teachers in the USA designed website resources as technology tools which assisted in the sharing of information and also for reference purposes. From these web-based resource tools, they downloaded lesson plans and performance assessment tasks that included the 3Rs and 4Cs.

The intensive support from leadership coupled with the 21st-century ICT teaching and learning tools augmented teachers' competency to engage learners in real-life situations (Partnership for 21st Century Skills, 2008:1). Monitoring and evaluation from a committed and supportive government motivated teachers to do their work

and enabled a framework for 21st-century learning to be realised. Teachers were not left on their own to achieve the set goals. As has been noted, this was a joint venture from all education stakeholders for the betterment of learners' education and a successful future.

As the result of the above information provided by different authors, teachers' ICT competencies in the USA are now at an advanced stage whereby they are able to develop web-based resource tools to enhance and support their teaching and learning. In addition, their transformed education is continuing to prepare learners to be employable and an informed citizenry who will undoubtedly thrive in the global economy (Partners for 21st Century Skills, 2009:1; Khe Foon & Thomas, 2007:1; Consortium for School Networking, n.d.:1). The USA, like all other government states, wishes to see its learners venturing into a bright future well equipped with ICT potentialities. With these views in mind, the section below examines teachers' ICT competencies from the South African perspective.

1.3.2 Teachers' ICT competencies in South Africa

Since the introduction of the new democratic South African government in 1994, the education system has witnessed tremendous transformation in governance, management, curriculum, and teacher professional development (Isaac, 2007:2). The key mechanism for the whole process of education transformation was to redress the imbalances which were created by the previous apartheid government system.

Initially, the South African education system was designed to prepare learners to meet the demands of the 20th-century workforce needs (Watson & Reigeluth, 2008:42). That system is now outdated and does not meet the needs of the 21st-century workforce. The 21st-century education system differs from that of the 20th century because of an information explosion within the system. In the 20th century, information was limited, but now in the 21st century the advancement of technology has brought massive volumes of information that learners can gain access to, beyond what is available in their school libraries. Teachers are expected to guide and lead learners on how to access and use these resources.

Furthermore, the introduction of e-Education policy in South Africa continues to pose a remarkable challenge to teachers and other stakeholders in the teaching and learning fraternity. According to this policy, every learner in the General Education Training (GET) and Further Education Training bands (FET) must be Information Communication Technologically (ICT) savvy by 2013 (Department of Education 2004:17). In addition, Howie, Muller and Paterson (2005:112) assert that most schools in South Africa increasingly use computers for monitoring learners and for administration purposes. For this reason, teachers and learners would seem to have limited access to the use of computers.

Different provinces in South African were tasked to get the integration of computers in teaching and learning off the ground. Each province had its own approach on how to ensure that the e-Education policy would be realised. Projects initiated in this regard included the Khanya project based in the Western Cape, *Gauteng Online* in Gauteng, and the Intel® Teach programme covering seven provinces namely Gauteng, Western Cape, Eastern Cape, Kwazulu-Natal, North West, Limpopo and Free State. The Teacher Laptop Initiative (TLI) and Thutong portal were other projects implemented to harness teaching and learning. All the above-mentioned projects will be more fully discussed in Chapter Three of this study.

The following table presents an outline of the weaknesses in implementation of computer usage in the South African context.

Table 1.1 Computer infiltration in South African Schools, 2005 (Adapted from Isaac, 2007:9)

Province	Total number of schools	% Schools with computers	% Schools with computers for teaching and learning
Eastern Cape	6,239	23.0	7.8
Free State	1,842	77.3	25.9
Gauteng	1,897	94.5	78.8
Kwazulu Natal	5,653	43.6	12.0
Mpumulanga	1,863	52.9	16.3
Northern Cape	422	91.0	60.4
Limpopo	4,187	41.8	8.7
North West	2,025	67.6	29.7
Western Cape	1,454	97.0	76.6
National	25,582	50.9	22.6

The above table clearly indicates that many schools have computers but not for teaching and learning purposes. This suggests that the integration of computers into teaching and learning is still limited in SA. Therefore, for it to take a root, government officials, policy makers and ICT specialists need to collaborate to generate a strategy on how to equip teachers with ICT competencies. The successful integration of computers in teaching and learning needs technological knowledge, skills and attitudes coupled with support from all educational stakeholders.

As in other parts of the world, the South African education system should be able to respond to pressure and challenges posed by technology advancement (DoE,

2004:13). The importance of the role that technology plays in teaching and learning raises the demand for training teachers in ICT usage so that they can effectively integrate computers in teaching and learning. The following paragraphs reveal what prompted me to conduct this study.

1.4 PROBLEM STATEMENT

For the purpose of understanding the context of this study, the following discussion outlines the environment in which the participants work. The map below indicates Bojanala District in North West (NW) province where this study was conducted.

Figure 1.1 Map of the North West Province and surrounds adopted from SA Tours and Safaris (Pty) Ltd (TOURSA), 2007

There are nine provinces in South Africa, and North West is one of them. The Bojanala District/Region is one of the four regions highlighted in the above map of North West Province. I selected the Bojanala District as it was convenient and within my proximity.

According to information provided by a CAT education specialist within Bojanala district, the picture of teachers' ICT competencies in the Bojanala District where the

fieldwork was done indicated that only 25 of the 134 secondary schools integrated computers in teaching and learning. Some schools in the district had computer laboratories full of unused equipment accumulating dust. This might indicate that teachers did not know how to employ computers for teaching and learning. Hence, I had the desire to find out why teachers were not integrating computers in teaching and learning.

Moreover, teachers had varying perceptions concerning computer integration in teaching and learning. Most of them, as mentioned earlier, had received computer literacy at pre-service training and had not been trained in integration and information skills. Tropakci (n.d.:1) and Afshari et al. (2009:89) assert that teacher training programmes mostly focus on basic computer literacy skills and do not pay sufficient attention to integration and information skills. Computer literacy means having acquired knowledge and understanding of computers and their use (Evans et al., 2010:664; Shelly, Cashman, Gunter & Gunter, 2008:4). Integration literacy implies the ability to use Information Technology (IT) combined with teaching and learning strategies to enhance learning (Shelly et al., 2008:4). Information literacy is defined as knowing how to find, analyse, use and communicate information (Shelly et al., 2008:4). Basically, these definitions support the importance of equipping teachers with ICT competencies. These three technology literacy skills would undoubtedly assist teachers to be competent in preparing 21st-century learners in the use of technology and to fit well into this ever-changing technological environment. The problem statement leads to the formulation of the following main research question, its sub-questions and subsequently to the main aim and objectives of the study.

1.5 THE MAIN RESEARCH QUESTION AND SUB-QUESTIONS

The main research question of this study was:

What are the secondary-school teachers' ICT competencies in classroom practices?

Three sub-questions emanating from the main question were as follows:

- How do secondary-school teachers integrate ICT in their classroom practices?
- What are the challenges experienced by secondary-school teachers when integrating ICT in classroom practices?
- What support do secondary-school teachers receive to effectively integrate ICT in classroom practices?

I used the first question to gather data through semi-structured interview strategy, the second question for the non-participant observation and the last question for document analysis.

1.6 THE AIM AND OBJECTIVES OF THE STUDY

The aim of this study was to investigate secondary-school teachers' ICT competencies in order to suggest a strategy for integrating ICTs in classroom practices.

The following objectives were also considered:

- To determine how secondary-school teachers integrate ICT in classroom practices.
- To explore the challenges that secondary-school teachers experience when they integrate ICT in classroom practices.
- To suggest the strategy that secondary-school teachers can use to integrate ICT in classroom practices.

The motivation below explains why I embarked on this study.

1.7 MOTIVATION FOR THE STUDY

The demand facing 21st-century teachers is that more and more learners get exposed to technological devices. What technology can offer appeals to them: understanding things through visual interaction with what they need to commit to their memories. It thus comes as no surprise that the 21st-century learners learn best by analysing, constructing knowledge, collaborating with peers and continual

assessment, not as passive recipients of knowledge (Casserly, 2007:17). By obvious implication, they require teachers who are knowledgeable and who possess technological skills that can enable them to facilitate a technology-integrated lesson. To achieve the new approach to teaching and learning, teachers should be on the forefront to acquire technological skills that could enable them to guide learners who are expected to contribute effectively to society through their technological expertise.

As a former Computer Application Technology (CAT) teacher, integrating computers in teaching and learning was part of my daily routine. Through my experience and observation I have realised that most teachers do not integrate computers in their classroom practices. Even though the South African policy on e-Education has long been introduced in the education system, little seems to have taken place in terms of its implementation. As stated previously in this chapter, South African learners are expected to be technological savvy by 2013. For Isaac (2007:8) and Wilson-Strydom and Thomas (n.d.:1) this means that learners should be able to perform the following:

- use ICT effectively to acquire the skills and knowledge that would enable them to participate effectively in the global community;
- utilise ICTs to augment their learning; and
- be connected to ICT infrastructure.

Furthermore, there is a belief that integrating ICT in teaching and learning maximises quality education (Mbangwana, 2008: 8; Pelgrum & Plomp, 2008:1). In particular, Blignaut et al. (2010:89) found that using ICT in teaching and learning was the key to augment classroom practices and foster the development of 21st-century learning skills. These are the mastering learning skills mentioned previously in this chapter, which are critical thinking, problem solving, communication, and collaboration, creativity and innovation (Partnership for 21st-century skills, 2009:3; Isaac, 2007:8; Ford & Botha, 2007:1). Notable evidence highlighted by these authors confirms that experimenting with ICT in schools exposes learners to new dynamic ways of learning. Instead of accepting information presented by teachers in a lesson delivery, they are given the opportunity to explore and discover on their own so as to achieve

meaningful learning. In this 21st-century education system, teachers are determinants of learners' future. This means 21st-century learners are dependent on teachers' ICT competencies to face technological challenges and to contribute effectively to society. Teachers are therefore obliged to be pace-setters in this fast-tracking, ever changing technological environment and enable learners to function in real-life situations. The significance of this study is the benefit its findings provide for teachers. A brief discussion of the value of this study is provided in the next section.

1.8 THE SIGNIFICANCE OF THE STUDY

The findings from this study could:

- assist in enlightening teachers about ICT competencies that could help them to effectively integrate ICTs in classroom practices;
- present the curriculum designers and specialist with a strategy that could be used for effective integration of ICTs in classroom practices and
- inform teachers about the challenges that hinder the effective integration of ICT in their classroom practices.

A preliminary impression of other authors' views concerning ICT usage follows below. An in-depth literature review is provided in Chapter Three of this study.

1.9 PRELIMINARY LITERATURE REVIEW

As professional employees, teachers require resources to perform their job effectively and efficiently. The 21st century provides technological tools that would enable them to perform more powerful tasks than before. The use of ICT would assist them to (Afshari, Bakar, Luan, Samah & Fooi, n.d.:3):

- enhance teaching and learning;
- improve learners' performance and achievement;
- prepare learners' 21st-century skills and
- prepare learners to be informed citizens.

To achieve the above-mentioned potentialities, teachers should model their ICT expertise so that learners in turn benefit in a technology-integrated lesson.

For Ololube (2006:103), teachers are regarded as the key persons in every educational environment. It is equally important that teaching and learning can be enhanced by the utilization of available ICT resources within the school premises. However, as mentioned earlier in this chapter, it is not an easy task for teachers to tailor technology tools to the learning outcomes and assessment standards of a lesson because of lack of expertise in selecting relevant ICT tools. However, this is possible if they are competent ICT users. Hence, it is evident that the use of ICTs in a classroom is an essential element in supporting and enhancing teaching and learning.

The ICT competency development of teachers is of paramount importance in this information age. Afshari et al. (n.d.:2) maintain that technology is indispensable for the success of teaching and learning in the 21st century. In support of the same idea, Albirini (2006:274) emphasises that teachers must possess knowledge, skills and attitudes regarding computer usage in order to prepare 21st-century learners for their future careers. Certainly, teachers are the only ingredients that could transform the digital age education system.

Regardless of how sophisticated ICT might be, it will never be practiced unless teachers are well trained on how to integrate it in teaching and learning. Goktas et al. (2009:277) assert that the demands for teachers with high ICT competence are increasing. This is caused by a mammoth increase of information brought about by technology advancement. To embrace ICT in teaching and learning is no longer an option but a must. Teachers need to be provided with the opportunity to do hands-on technology as part of their professional development so that they become competent ICT users. Inadequate professional development gives rise to a lack of understanding on the use of technology in the classroom (Afshari et al., 2009: 89; Lau & Sim, 2008: 20). Unless teachers are sufficiently and properly trained on ICT integration, the tool would not be used or have no value at all.

Very limited research has been conducted concerning teachers' ICT competencies in classroom practices. More research needs to be conducted and this has also prompted me as the researcher to pursue this field of study. Furthermore, it is essential to note how this study was framed, which is the topic of the next section.

1.10 CONCEPTUAL AND THEORETICAL FRAMEWORKS FOR THIS STUDY

This study was framed within the Technological Pedagogical and Content knowledge (TPACK) conceptual framework. This framework was designed by Koehler and Mishra (2009:1) and consists of three components: Technology, Pedagogy and Content. TPACK was initially based on Shulman's work (1986) on Pedagogical Content Knowledge (PCK) and Koehler and Mishra (2009:1) have built on these core ideas through the inclusion of technology. The three components of this framework overlap and produce a truly meaningful and deeply skilled unique knowledge needed by teachers to effectively integrate technology in teaching (Koehler, Mishra & Yahya, 2007:743; Koehler & Mishra, 2006:1029). The understanding of this framework would enable teachers to model the technology skills combined with relevant teaching and learning strategies to deliver subject matter in a productive manner. Chapter Two provides an in-depth picture of this conceptual framework. A connectivism theoretical framework was also included in this study as it involves how learning should be understood in the digital age. Below, I present the research design that gave a picture of the route that I followed to achieve the aim and objectives, and also to answer the research questions of this study.

1.11 THE RESEARCH DESIGN

1.11.1 Qualitative research method

In this study I employed a qualitative research method. According to Anderson, this research method (2009:180) is used to gather data in the form of words and language from observations, semi-structured interviews, documents and focus

groups. In this study, I gathered data from sampled participants through semi-structured interviews, non-participant observation, and document analysis.

1.11.2 A case study design

A case study was considered appropriate for this study. For Lazar, Heidi Feng and Hochheiser (2010:144) and Cohen, Manion, and Morrison (2007:254), a case study is done according to the following principles:

- it is conducted within a localised area in a natural context;
- the focus is on educational activity; and
- it takes into account ethnicity and the significance of the study.

In this study, detailed data in the form of words and language about the set topic was drawn from a small group of secondary-school teachers who integrated ICTs in their classroom practices. Fieldwork was done within a specific period of time in the selected secondary schools' settings which were referred to as cases in this study. In all instances I visited the participants at their respective workplaces to conduct semi-structured interviews, observe them and perform document analyses.

1.11.3 Ethical considerations

Ethical consideration is regarded as avoiding the possibility that confidentiality may be violated (Royse, 2008:62). It is also about requiring the researcher to account for involving participants. Informed consent was crucial. This was an agreement about participating in the research project between me as a researcher and the participants. The guidelines pertaining to ethical consideration which were used in this study were the following: voluntarily participation, anonymity and confidentiality. An in-depth discussion about this is provided in Chapter Four.

1.11.4 Population and sampling

Purposive sampling as suggested by various authors (Anderson, 2009:202; Wiersma & Jurs, 2009:342; Royse, 2008:212) was used deliberately to elicit rich information from teachers who integrated ICTs in teaching and learning and in view of their

experiences and expertise in the implementation. The targeted population was secondary-school teachers who were knowledgeable about the use of ICT in teaching and learning. I requested two teachers from four site managers who integrated ICTs in teaching and learning.

1.11.5 Data collection strategies

For the purpose of this study, data collection strategies were semi-structured interviews, non-participant observation, and document analysis. The use of multiple data collection strategies enables triangulation of the results and this, according to Briggs and Coleman (2007:100) and Lazar et al. (2010:295), determines accuracy in data collection or support in the interpretation of data. Data through semi-structured interviews was collected from eight secondary-school teachers within Bojanala district, two selected from each secondary school. All semi-structured interview sessions were audio-taped through the use of a Samsung Galaxy Note II cell phone and thereafter transcribed. I also observed the same eight teachers who participated as interviewees. All the observed teaching and learning lesson presentations were video-taped. The data was generated from informal documents which were in the selected secondary schools. These included teachers' technology-integrated lesson plans, minutes of staff meetings and records of strategy meetings for implementation of ICTs in classroom practice. The informal documents were requested from the four school site managers.

1.11.6 Data analysis

Data analysis was done according to the procedure suggested by Creswell (2007:156-157) and the four key steps of the data analysis process identified below by Anderson (2009:213):

- the researcher should understand and assess the information collected;
- the information should be reduced to manageable proportions;
- the researcher should explore key themes and patterns; and
- the researcher should make meaningful conclusions that can be justified on the basis of the analysis.

After understanding, summarising and devising categories for the collected data, the process of coding commenced. Recurring themes or phrases and events that appeared to be noteworthy were put together. This process is called coding (Anderson, 2009:216; Wiersma & Jurs, 2009:238). For the interview sessions, I created a table with questions, descriptions, interviewees, codes and themes. With regard to observation, I compared the participants' technology-integrated lesson plans with the lesson plan included in Chapter Three (refer to table 3.8.2.). My focus was on the learning outcomes, lesson outcomes, assessment standards, scenario, teaching method, teaching and learning activities. I also considered the TPACK conceptual framework as it depicts an effective integration of ICTs in teaching and learning. For document analysis, I again created a table which indicated the similarities in the documents analysed. I interpreted the coded data and thereafter portrayed the presentation in word tables, figures and photos in order to give a more detailed and understandable version.

1.11.7 Measures to ensure trustworthiness

To ensure trustworthiness in this study, four issues were established, namely credibility, transferability, dependability and transferability. These four issues were used to assess the quality of this study. For Lincoln and Guba (1985) quoted in Babbie and Mouton (2012:276), the key principle of good qualitative research is the notion of trustworthiness. More information about these issues is provided in Chapter Four of this study. The plan of the study below gives the skeletal structure of what is included in each chapter.

1.12 PLAN OF THE STUDY

Table 1.2 The plan of the study

CHAPTERS	CONTENT	BRIEF DESCRIPTION
1	Introduction and background	This chapter includes the introduction, the use if ICTs worldwide, problem context, problem statement, the main research question and sub-questions, the aim and objectives, motivation of the study, preliminary literature review, conceptual and theoretical frameworks, the significance of the study, a brief explanation of the research design, ethical consideration, measures to ensure trustworthiness, plan of the study, and definitions of terms.
2	The paradigmatic stance of the study, conceptual and theoretical frameworks.	This chapter explains the paradigm stance of this study and further clarifies its conceptual and theoretical frameworks
3	Literature review	A detailed literature review is reflected in this chapter. The focus was on the following: why technology has captured the minds of many people globally, integration of ICT in South Africa as compared to developed countries, ICT initiatives in SA, ICT competencies, the UNESCO's ICT competency framework for teachers, teachers as change agents in education system and how teachers are expected to

		integrate ICT in teaching and learning.
4	Research Design and Methods	This chapter contains a detailed research design, embracing qualitative research methods and case study design, ethical considerations, target population that was sampled, data collection strategies, analysis of the the collected data, and measures to ensure trustworthiness.
5	Data presentation and analysis of the findings.	This chapter includes a comprehensive analysis, interpretation and discussion of the findings of the study.
6	Summary of the findings, recommendations and conclusions.	This final chapter contains a summary of each chapter, summary of the main findings, the suggested strategy for effective integration of ICT in teaching and learning, the limitations of the study, suggestions for further studies, recommendations, and reflections pertaining to this study.

1.13 DEFINITION OF TERMS

The following working concepts for the study are defined:

- Information and Communication Technologies (ICTs): These are the combination of networks, hardware and software as well as the means of communication, collaboration and engagement that enable the processing,

management and exchange of data, information and knowledge (DoE, 2004:15; ICT in education, n.d:1.). When teachers integrate ICT in their classroom practices, the end result would be the improvement of learners' performance and their progress towards participating well within the rich technological environment.

- Technology Integration: This refers to the incorporation of all technological tools together with each subject-related area of the curriculum to boost student learning and learners' efficiency (Shelly et al., 2008: 327). Technology integration embodies ICT usage which also includes computers as a hardware tool which is mostly used in school settings.
- Strategy: This is referred to as a systematic plan of action designed to attain a certain goal (Web definition of strategy, n.d.:1).
- Competency: Goktas et al. (2009:277) and Desjardins et al. (n.d.:212) define competency as the state or quality of being well qualified to act upon a specific problem or to perform a task.

1.14 CONCLUSION

This chapter has provided a skeletal structure of this study, including the use if ICTs worldwide, the problem context and problem statement, the main research question and sub-questions, the aim and objectives, the motivation of the study, a preliminary literature review, how this study was framed, the significance of the study, a brief explanation of the research design, ethical considerations, measures to ensure trustworthiness, the plan of the study and a definition of terms.

CHAPTER TWO
CONCEPTUAL AND THEORETICAL FRAMEWORK FOR THE STUDY

2.1 INTRODUCTION

This chapter presents the paradigm stance of this study and dwells deeper into how the study was framed. According to Carter and Little (2007:1316), a paradigm stance guides the methodological choices and the frameworks that shape a study. Epistemology as a paradigm stance of this study kick-starts the discussion, and is then followed by a discussion of the connectivism theoretical framework and Technological Pedagogical Content Knowledge (TPACK) conceptual framework. A conclusion at the end gives a summary of all discussions.

2.2 THE PARADIGMATIC STANCE OF THIS STUDY

This study was grounded in the epistemological interpretive paradigm perspective which is referred to as the nature of knowing or how people come to know (Truncellito, n.d.:1; Carter & Little, 2007:1317). An epistemological interpretive paradigm stance was specific for this study because it emphasises the construction of knowledge and how this knowledge is shared and applied by the participants. In this study, such knowledge should assist teachers to effectively integrate ICT in their classroom practices. This idea reflected teachers' ICT competencies that this study investigated. As highlighted by the consulted authors in Chapter One of this study, competency is the state or quality of being well qualified to perform a task (Goktas et al., 2009:277), to be well qualified to perform a task implies being knowledgeable to execute a certain task. Hence, teachers are expected to possess deep ICT knowledge and skills that would enable them to facilitate a technology-integrated lesson. As knowledgeable ICT competent users they would meticulously prepare learners for the 21st-century technological challenges.

2.3 CONNECTIVISM THEORETICAL FRAMEWORK

George Siemens proposes connectivism as a learning theory for the digital age (Bell, 2011:3; Kop & Hill, 2008:1; Siemens, 2004:1). Connectivism as a theoretical framework was used in this study in order to understand integration of ICTs in the teaching and learning environment. This theoretical framework contributes to the 21st-century learners' learning needs that warrant the use of technology in the education system. In other words, it provides a different approach that makes teaching and learning understandable. For this purpose, the 21st-century education system requires teachers who are knowledgeable in ICT usage so as to develop the 21st-century learners' skills to meet these needs. Equally important, teachers' ICT competencies and accessibility to technological devices play a pivotal role in this regard. They are expected to be competent ICT users so that in turn they assist learners to develop the 21st-century skills.

According to Kop and Hill (2008:1), in connectivism knowledge is shared through social media networking tools and can be captured in different digital formats. In the same document, Kop and Hill (2008:1) further highlight two important skills that contribute to learning, namely the ability to search for current information and also the ability to share relevant information with counterparts. This could only be achieved if 21st-century learners have the potential to explore search engines and are able to access communication tools to share scholastic information. In the digital age, it would be the responsibility of a teacher to ensure that learners are well prepared to seek information for a task and share it with peers. Moreover, this information sharing (social media) skill has been pointed out by authors (Desjardins et al., n.d.:214; Baron, n.d.:25) in Chapter One of this study as one of the ICT competencies that are worthy to be acquired to effectively integrate ICTs in teaching and learning. ICT competencies will be further detailed in Chapter Three of this study.

Siemens (2004:2) has come up with the following set of principles of connectivism:

- learning and knowledge relies on shared information;

- learning is a process of connecting specialised nodes of information sources;
- learning may take place through tools;
- exposure to more information is more critical than what is currently known;
- nurturing and maintaining sharing of information is needed for lifelong learning;
- ability to synthesise information is a core skill; and
- updated knowledge is the intent of all connectivist learning practices.

As outlined above, the principles of connectvism stress learning as a distribution of information and knowledge across networks of people that promote active participation (Bell, 2011:4). This implies the ability to search and synthesise information through various search engines, thereafter to employ various social networking tools to disseminate it; in this way updated information is always shared because users are forever kept in touch and this becomes a lifelong learning process. In the context of this study, teachers as sources of knowledge are expected to be competent social media tool users. They are supposed to search information from different social media tool functionalities so that in turn they show learners how to benefit from them. It is therefore becoming increasingly imperative that teachers adapt to the use of technological tools and restructure their teaching and learning approaches accordingly.

What is limited in this theory is that the use of social media tools in isolation would not cover ICT transformative potentialities ushered in by technological advancement. There is a need to embrace all ICT competencies in the teaching and learning environment in order to prepare learners for their career path that matches this information age. Arguably, Bells (2011:4) supports this idea that the framework of connectivism alone is insufficient as a theory to inform a technology-integrated lesson. He further contends that connectivism's existence inspires teachers and learners to alter classroom practices but that it should be built as a theory in conjunction with significant qualitative studies that inform its development within the context of other theories. The conceptual frame work of TPACK is presented below.

2.4 TPACK CONCEPTUAL FRAMEWORK COMPONENTS

The TPACK conceptual framework best suited this study as it provided the lens through which to view teachers' ICT competencies in classroom practices. In other words, the semi-structured interview questions, non-participant observation information and document analysis checklists were formulated in line with this framework. Teachers' ICT competencies were investigated through the above-mentioned data collection strategies. Teachers' ICT competencies are vital to effectively integrate ICTs in teaching and learning. Therefore, their understanding of TPACK might be a key that could enable them to effectively integrate ICTs in their classroom practices.

TPACK was designed by Koehler and Mishra in 2006 (Ward & Benson, 2010:483; Doukakis, Psaltidou, Stavraki, Adamopoulos, Tsiotakis & Stergou, 2010:443) and consisted of three components, namely technology, pedagogy and content. Initially, TPACK was based on Shulman's work (1986) on Pedagogical Content Knowledge (PCK), and then Koehler and Mishra (2009:1) built on these core ideas through the inclusion of technology. The TPACK framework was invented with the understanding that teaching has become an extremely complex activity that embraces many kinds of knowledge (Koehler & Mishra, 2006:1020). In essence, technology has brought enormous information which constantly necessitates new knowledge for approaching teaching and learning environments. The inclusion of technology in this regard necessitates new avenues to approach the education system. UNESCO (2011:8) regards these new avenues as changing teachers' role in teaching, new pedagogies, information management and development of learners' 21st-century skills. Teachers are seen as the cornerstone in transforming the information age education system. They need to be made aware of the important role they should play in the use of technology in the teaching and learning fraternity.

The three components of TPACK, technology, pedagogy and content, overlap and produce a truly meaningful and deeply skilled unique knowledge needed by teachers to effectively integrate technology in teaching and learning (Ward & Benson, 2010:484; Archambault & Crippen, 2009:72; Koehler & Mishra, 2009:3; Schmidt,

Baran, Thompson, Mishra, Koehler & Shin, 2009:125). Equally important is the view that this framework showcases a holistic picture of ICT integration in teaching and learning (Evoh, 2009:2). With this in mind, teachers are expected to model technological skills combined with relevant teaching and learning strategies and offer subject matter in a creative manner. In the context of this study, secondary-school teachers' ICT competencies were under scrutiny as teachers were supposed to demonstrate this unique knowledge as competent ICT users. Teachers' ICT competencies were explored through understanding how they integrated ICTs within school environments in their everyday life.

Figure 2.1 depicts the TPACK conceptual framework and the multifaceted nature of knowledge needed by a teacher to effectively integrate technology in teaching and learning.

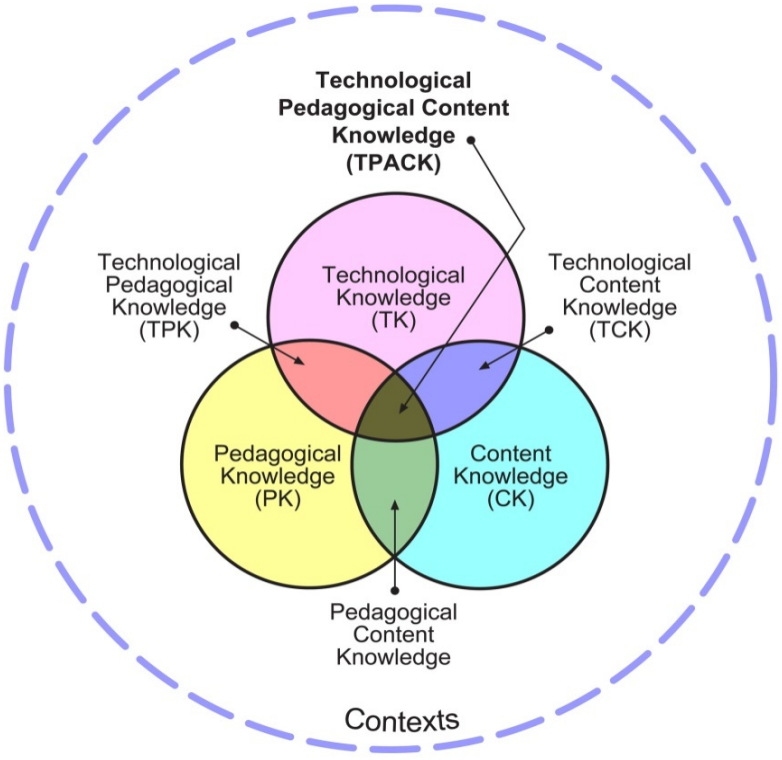


Figure 2.1 The TPACK conceptual framework and its knowledge components

(Adopted from Koehler & Mishra, 2006:1025)

A brief overview of each component is provided below:

2.4.1 Technological Knowledge

The first circle at the top of the TPACK conceptual framework represents Technological Knowledge (TK). Technological knowledge represents a deeper knowledge that teachers should possess about different types of technologies that could be used to enhance teaching and learning. These could include among others the overhead projector, whiteboard, and more advanced technologies such as the Internet, digital video, software applications, desktop and laptop computers (Koehler & Mishra, 2009:4; Koehler et al., 2007:743). Through this knowledge teachers are expected to structure their teaching and assessment activities in such a manner that they make learning easier and more comprehensible to learners.

The information age has ushered in more advanced technologies that leave teachers with no choice but to embrace the use of ICTs to guard against being left behind in this 21st century. They are expected to be able to identify an appropriate technological tool for their lessons. Moreover, it is imperative that technology devices should not be regarded as add-on tools in the teaching and learning environment, but teachers should know exactly when and why to employ them. The integration of technological tools depends on the curriculum, in other words the curriculum drives ICTs usage in teaching and learning. In essence, teachers should have a vast knowledge of different technologies, not only to identify them but also to demonstrate their ICT expertise through engaging them in the teaching and learning environment.

Technological knowledge enables teachers to face challenging tasks that they could never have managed without its usage. What is worrying is the thorny challenge of the rate at which it changes functionalities and this means teachers are expected to be on the lookout for new upcoming devices so as to be updated and move with new technological developments all the time. In the context of this study, I witnessed the potentialities of secondary-school teachers in the choice of appropriate technological

tools for their lesson deliveries. In the same manner I expected that particular tool to enable him or her to achieve lesson outcomes.

2.4.2 Pedagogical Knowledge

Pedagogical Knowledge (PK) is represented by the first circle on the left in the above TPACK figure. PK is a deep knowledge that teachers should acquire which entails processes and techniques or methods of teaching a particular subject (Koehler & Mishra, 2009:3; Koehler & Mishra, 2006:1026). According to Koehler et al. (2007:743) and Schmidt et al. (2009:125), a form of knowledge used by teachers to understand how learners learn consists of general classroom management skills, lesson planning, student assessment, implementation techniques, values and purposes of teaching such a subject.

A teacher who is well versed with PK understands how learners construct knowledge and also has potentialities of assisting learners to develop a positive attitude towards learning (Evoh, 2009:2; Koehler & Mishra, 2006:1026) Therefore, when a teacher prepares a lesson plan he/she should consider learners as a target audience, and find out their prior knowledge in order to link the new knowledge to their previous knowledge. This would ease the facilitation of a technology-integrated learning environment.

The assessment standards also play a vital role as a yardstick to determine whether learners understand classroom activity or not. In fact, the assessment results would enable teachers to structure their remedial work for underperforming learners appropriately. A teacher should be able to use a variety of teaching approaches to cater for all learners' diverse capabilities. As such, PK would enable them to address obstacles that might hinder learners' learning. On the whole, the idea behind this component revolves around teachers' knowledge of how learners learn. The potentialities included in this PK are not linked to the use of technology in teaching and learning, which is the core in this study. However, teachers are only advised to use different approaches as has been highlighted.

2.4.3 Content Knowledge

Content Knowledge (CK) is represented by the second circle on the right-hand side in the TPACK figure. According to Koehler et al. (2007:743) and Koehler and Mishra (2006:1026) CK is teachers' deep knowledge of a particular learning area (subject) of his/her speciality. This particular teacher is expected to impart this content knowledge to learners in a teaching field. CK plays a pivotal role in teaching and learning. This means that teachers should demonstrate their expertise in delivering such a subject.

From the outset, teachers are supposed to have acquired content knowledge at pre-service teacher training colleges or institutions. They should have been meticulously developed to offer a specific subject of their choice and are therefore expected to impart that knowledge to learners in their teaching and learning field. In other words, every teacher possesses unique potentialities of a particular subject and is expected to equip learners with such knowledge for career path development. Content knowledge would best suit this study if it is linked to technology and this will be discussed later in this chapter.

2.4.4 Technological Pedagogical Knowledge

The two components Technology and Pedagogy intersect and bring forth Technological Pedagogical Knowledge (TPK) as indicated in the above TPACK figure. Technological Pedagogical Knowledge (TPK) implies how technological tools can enhance teaching and how teaching may be transformed as a result of using a specific technological tool (Ward & Benson, 2010:484; Koehler & Mishra, 2006:1028).

The intersection of these components describes teachers' ICT competencies, which entail how teachers select an appropriate technological tool that could assist in enhancing teaching and in turn improve their pedagogical practices. In essence, the TPK has two functions: on the one hand, it enhances teaching; on the other, it develops teachers' pedagogical practices. The use of technology in the 21st century forces teachers to change from a traditional teaching approach to learner-centred

approaches. In particular, 21st-century teachers are expected to be competent ICT users as this would be a key to effectively facilitate a technology-integrated lesson.

In addition, according to TPK the use of technologies requires teachers to be creative in delivering their specific subject matter or lessons. They are therefore supposed to apply new approaches in teaching which can transform learning in an amazing way; however, this would depend on the availability of technology tools and their technological skills. What is implied by a combination of these components is that the effective use of technology tools and relevant strategies provides new perspectives for understanding a phenomenon (Koehler & Mishra, 2009:4). A combination of a number of technological tools could be employed to achieve a particular lesson outcome.

For the purpose of this study, the focus on TPK was on observing secondary-school teachers modelling the shift from traditional teaching approaches to the new constructivist or learner-centred approach. Teachers showcased what they articulated during interview sessions concerning the use of technology in teaching and learning.

2.4.5 Technological Content Knowledge

Technological Content Knowledge (TCK) demonstrates the substance of understanding the impact of technology on specific content or subject, or the impact of content on specific technology (Koehler et al., 2007:743; Koehler & Mishra, 2006:1028). Most teachers are likely to master their subject matter. According to TCK, however, they are also expected be familiar with how the use of technology can manipulate subject matter and make it interesting and understandable. The relationship between these two components necessitates maintaining equilibrium between the two components. In other words, deep knowledge of a specific content would assist teachers' choice of an appropriate ICT tool and that particular ICT tool should synchronise well with that very same content.

The combination of the two components places teachers at the advanced technology integration benchmark which is required of teachers in the 21st century. Still,

teachers should be careful with the combination of the two components, because if one is limited, the other one would obviously be affected. This means that when teachers are well established with the content, this knowledge would assist them to choose an appropriate technological device. As a result, the lesson outcomes would obviously be accomplished. In the same way, teachers are expected to use appropriate technology and deliver subject matter in an appealing way. In conducting fieldwork for this study, I observed how the participants used technology to enhance the achievement of lesson outcomes.

2.4.6 Pedagogical Content Knowledge

Pedagogical Content Knowledge (PCK) is the intersection of pedagogy and content components depicted in the above TPACK figure. It entails teachers' understanding of the relationship between subject matter and teaching strategies (Koehler et al., 2007:743; Koehler & Mishra, 2006:1028). The core idea behind this relationship implies teachers' potentialities to present content in an improved manner. Teachers who are self-assured with PCK are able to transform subject matter and make it comprehensible to their learners. Such teachers would take pains to explore alternative strategies that would facilitate learning. Ward and Benson (2010:484) argue that learning takes place when a teacher is able to adapt pedagogy to meet the unique content of a particular subject. For example, according to Koehler and Mishra (2009:4) a technique that transforms content in order to be easily understood happens when:

- the interpretation of the subject matter is thoughtfully done;
- multiple methods are employed to represent it; and
- the instructional materials are adapted and tailored to alternative conceptions and students' prior knowledge.

Through the ideas mentioned above, teachers can make teaching more adaptive to learners. Teachers are not only expected to be acquainted with content but should also be in the position to deliver content in a way that motivates learners to seek for more information. The focus in this study is the use of technology in teaching and

learning. PCK is essential in teaching and learning; however, it has to engage technology in order to be part of a unique knowledge needed by teachers to effectively integrate ICTs in classroom practices - which is TPACK.

2.5 TPACK CONCEPTUAL FRAMEWORK IN A CLASSROOM

The Technological Pedagogical and Content Knowledge (TPACK) framework lays a foundation on which teachers could base a successful integration of technology in teaching and learning. Knowledge of this framework would enable teachers to design fruitful technology-integrated lessons. Mishra and Koehler (2006:1025) emphasise that this framework is central for developing good teaching; accordingly, the three components should never be treated separately as they present a complex interplay in a technology-integrated lesson. Teachers are supposed to understand the mutual relationship embraced within these components which are based on the following (Mishra and Koehler, 2006:1029):

- illustration of ideas using technologies;
- teaching and learning strategies combined with technologies to offer subject matter in a constructive manner;
- knowledge of what makes concepts difficult or easy to learn;
- the use of technology to redress challenges learners face;
- learners' prior knowledge as well as theories of epistemology;
- how technologies can be used to augment existing knowledge; and
- developing new epistemologies or strengthening old ones.

According to the illustration above, teachers are supposed to showcase the use of technology in different classroom activities. By so doing, the strategy or presentation approach should inform the chosen technological tool. In some instances teachers would be forced to rely on technology in order to address challenges that learners might face in learning. For instance, the use of educational software alleviates teachers' stress of reaching the learners. This approach could be a 21st-century teaching approach which has been simplified to enhance teaching and learning. Furthermore, learners' prior knowledge plays an essential role as it guides teachers

to know exactly which concepts in content would need emphasis or more clarity. Ward and Benson (2010:484) espouse the idea that accommodating prior knowledge also helps learners to align their existing knowledge to new learning content. Linking learners' prior knowledge to new information is like helping learners to cruise from a known to an unknown destination. Knowledge is the primary requirement for learners' future careers. In this information age, when knowledge is required, the use of technology as a vital skill might close the gap between the known and the unknown.

Moreover, knowledge of theories of epistemology would assist teachers to engage learners in classroom activities that would help them to construct knowledge from their own experiences. In the classroom context in this study, teachers were expected to guide learners and scaffold a meaningful learning environment.

The argument behind this framework is that effective integration of technology in teaching and learning requires a thoughtful interweaving of all three sources of knowledge and also should not treated in isolation (Koehler et al., 2007:744; Mishra & Koehler, 2006:1029). This, as mentioned earlier on in this chapter, implies that deep content knowledge can assist teachers to choose a relevant technological tool that would ensure the achievement of lesson outcomes. In preparation of a technology-integrated lesson the choice of pedagogy depends on the choice of technological tool. The idea behind this is that a teacher would be guided by the type of technological tool selected to decide on a particular pedagogy. Similarly, a teacher would not struggle to choose a strategy or teaching method for a lesson because the choice of technological tool informs the choice of strategy or method. Hence, technology, pedagogy and content components should not be treated separately because each has a specific role to play in a technology-integrated lesson. This would ensure quality teaching and expertise demonstrated by teachers in the delivery of a technology-integrated lesson.

According to Doering, Veletsianos, Scharber and Miller (2009:322) the innovation of TPACK framework offers a possible solution to the transformation of teaching and learning. Similarly, Shelly et al. (2010:390) attest that theories are important in

education systems because they assist teachers to understand how learners learn. Moreover, knowledge of theories can improve their pedagogy and subject matters delivery. The main aim of this study was to investigate secondary-school teachers' ICT competencies in classroom practices. I hoped that teachers' knowledge of TPACK would enable them to effectively integrate technology in classroom practices. The interweaving of three components model what is expected to be done in a technology-integrated lesson. This is the unique knowledge needed by teachers to effectively integrate ICTs in teaching and learning. In essence, the 21st-century education system requires teachers who have new skills driven by technology. This is the gist of this study; that is, the medium through which teachers' ICT unique knowledge could be explored. In this study, teachers were expected to do the following in their technology-integrated lessons:

- choose a relevant technological tool which would enable them to achieve lesson outcomes;
- use teaching strategies that would match the chosen technological tool and augment the achievement of lesson outcomes;
- use teaching methods that were linked to the choice of technological tool; and
- involve teaching and learning activities in accordance with teaching strategies, teaching methods and technological tools.

It is also noteworthy to highlight the implications of these frameworks in the study. The discussion follows below.

2.6 IMPLICATIONS OF THE FRAMEWORKS

Both TPACK and Connectivism recognise knowledge as the source of successful technology-integrated lessons. However, the acquisition of knowledge is approached from different perspectives. On the one hand, connectivism falls short of embracing all ICT competencies mentioned by authors Desjardins et al. (n.d.:214) in this study. It only forms part of ICT competencies, namely social media. In addition, connectivism caters only for individuals who are connected to the internet and are liable to participate in knowledge sharing. Although the use of the internet involves a

broad choice of tools to use in a technology-integrated lesson, it is not advisable to consider the usage social media tools in isolation. Other ICT competencies should also be taken into account. Moreover, connectivism as a theoretical framework advises both teachers and learners on how to participate in a technology-integrated lesson, but the TPACK conceptual framework is strictly meant for teachers. TPACK, on the other hand, embraces all ICT competencies. Teachers are expected to acquire the unique knowledge entailed in the TPACK conceptual framework and demonstrate their ICT expertise potentialities in a technology-integrated lesson. Knowledge of TPACK would assist them to practice what is entailed in connectivism. In the same way, the knowledge of the connectivism theoretical framework would undoubtedly augment the TPACK framework knowledge for the effective integration of ICTs in teaching and learning.

In this study TPACK was employed as a conceptual framework through which teachers' ICT competencies could be understood. The 21st-century teachers should be equipped with the unique knowledge highlighted by different authors in this chapter. The use of ICTs should enable secondary teachers to fit into a technologically savvy global community. In fact, being ICT competent users would enable them to pave an employable career path for learners. However, secondary-school teachers might not realise the value of being competent ICT users, in which case the schools' stakeholders should find ways to expose them to ICT potentialities. This could be through in-service training so that they do not lose touch or they should be updated on new technological developments. The understanding of TPACK would change their way of thinking on how to approach teaching and learning in the 21st century. All in all, the use of ICTs in teaching and learning is here to stay and no secondary-school teacher should be left behind, otherwise his or her career would sooner or later be obsolete. Teachers' ICT competencies play a significant role in the 21st century. As mentioned in the previous chapter, Desjardins, Lacasse and Belair (n.d.:214) and Baron (n.d.:25) distinguish four types of ICT competencies, namely technical, informational, epistemological and social. The four ICT competencies are in line with the TPACK conceptual framework and connectivism basics through communication networking tools. For example the

technical aspect in both ICT competencies and TPACK requires the ability of teachers to perform trouble shooting during facilitation of a technology-integrated lesson. The epistemological ICT competence involves the ability of a teacher to transform subject matter (content) in a manner that draws learners' attention and enhances the achievement of learning outcomes as well. This transformation of subject matter in TPACK is technological content knowledge, which corroborates that the use of ICTs in teaching and learning can change teachers' teaching strategies. This implies that the use of ICTs can assist teachers to change their teaching strategies. In essence the use of ICTs in teaching and learning can improve teachers' pedagogical practices. The connectivism theoretical framework is related to the informational and social ICT competencies which centre on the mass of information brought by the advancement of technology and as such necessitates the interaction of users through ICT communication networking tools.

2.7 CONCLUSION

The connectivism theoretical framework emphasises the use of a social networking technological device in teaching and learning as augmenting the efforts that teachers usually make. This is an extra mile that teachers should go in order to make teaching and learning interesting. In support of this argument, Siemens (2012:5) asserts that tools increase humans' ability to broaden thinking skills and share information. In essence, connectivism as highlighted in this chapter forms part of ICT competencies which entail the use of social media.

TPACK makes sense of what is expected of teachers in a technology-integrated lesson. The ICT competencies mentioned in Chapter One gave a direction of what was needed to answer the research questions and now are aligned to the unique knowledge explored in this chapter. The key components of teachers' knowledge in the thoughtful use of technology have been explored. It is essential that teachers should be made aware of this framework for successful use of technology in classroom practices. TPACK indeed clarifies to teachers how technology can be applied in an interesting and intelligent way (Koehler & Mishra, 2006:1045). Shelly et al. (2010:390) emphasise that learning is a complex task merged with difficulty on

how to observe it. In this chapter, the authors have fully conveyed that the use of ICTs is opening new avenues in teaching and learning. In short, the innovation of TPACK and connectivism could open new avenues for 21st-century teachers to effectively integrate technology in teaching and learning. In Chapter Three, other authors' views concerning the use of technology will be explored.

CHAPTER THREE
THE ROLE OF INTEGRATING ICT IN TEACHING AND LEARNING

3.1 INTRODUCTION

This chapter profiles ICT integration in teaching and learning. It highlights the reasons why technology has captured the minds of so many people globally. In addition, the chapter also focuses on the use of ICTs from a South African perspective as a targeted country. It is vital within the context of this chapter to clarify ICT competencies that teachers are expected to model to ensure the effective integration of ICTs in teaching and learning, which of course is the main purpose of this study. Equally important is to note the United Nations Educational Scientific and Cultural Organisation's (UNESCO's) own ICT competency framework for teachers which sheds light on what is expected of teachers in the use of ICTs. In this regard, the role of teachers as key agents for steering the essence of this study is considered, while a technology-integrated lesson plan is included to outline how teachers are expected to structure and deliver subject matter. In the concluding section, I consolidate the important ideas raised in this chapter.

3.2 WHY THE USE OF ICT IN EDUCATION?

Technology is ever transforming the entire world and is increasingly touching every aspect of peoples' daily lives (Anderson, 2010:2; UNESCO, 2010:2; Mueller, Ross, Specht, Willoughby & Wood, 2008:1523; Teo, 2008:413). Teachers are thus expected to acquire technological skills, knowledge and attitudes that would enable them to transform the education system. What raises concern is the rapid rate of its advancement and the manner in which it is continuously affecting the education system. Certainly, it has a profound influence on knowledge acquisition for teachers and learners. There is an increasing belief worldwide that ICT tools amplify

education systems and pave ways for learners' successful career paths (Goktas et al., 2009:194; Koc, 2005:72). Consequently, its infiltration into the education system poses a challenge for countries and their governments concerning the future of their 21st-century learners.

Blignaut et al. (2010:89) as well as Baskin & Williams (2006:13) assert that ICT in education better prepares learners' 21st-century skills. These skills, as indicated in Chapter One (Shelly et al., 2010:14; Magana & Frenkel, 2009:1; Partners for 21st century skills, 2009:1), are the 3Rs and 4Cs. This means that the 21st-century learners are expected to do the following:

- use ICT communicating tools to interact with the global community;
- collaborate with peers, and share ideas through the use of appropriate ICT devices;
- ultimately become critical thinkers through the use of these tools;
- become creative and innovative with the help of ICT tools; and
- by means of ICTs, apply strategies in solving problems they were unable to accomplish before.

Equally important is to equip learners with skills that are relevant for the complexities of 21st-century life through the promotion of economic growth, job creation, social development, and global competitiveness (Isaac, 2007:5; Ford, 2007:3). It is an undeniable fact that technology has ushered in new knowledge and modern devices that can improve learning and assist in the development of such 21st-century skills.

Moreover, the 21st century is characterised by an information explosion which has been brought about by a speedy acceleration of technological advancement. This information explosion assists in the creation of new knowledge as more ICT devices are developed. The ICT applications force the education systems to take on new shapes. This means that they have to move from traditional approaches (teacher centred) to teaching and learning to the constructivist (learner centred) teaching and learning approach. No wonder, therefore, that education experts and stakeholders are concerned about what to anticipate through the use of ICTs, which have become

the catchword of every corridor. Therefore, there is a need to rethink and reshape the education systems to keep pace with new technological developments.

Furthermore, the digital natives (21st-century learners), as some authors name them, have diversified needs that force curriculum developers to find creative ideas that could boost these learners' potentialities. The 20th-century educational needs differ completely from 21st-century educational needs. Twenty-first-century learners are exposed to a mass of information through these technological advances. Hence, education environments should embrace the educational paradigm shifts of the information age.

In essence, many countries are now beginning to rely on the ICT skills of their youth, who are expected to be ready to experience the real world as informed citizens. They are regarded as the future of a country and may determine its collapse or success. They have to be prepared globally to successfully face the challenges posed by this technology. The youth is expected to reinvest in society after acquiring a particular career, which is convenient and cost effective for the life of that society; consequently, most countries are transforming their education systems to be consistent with technological developments and expectations (Dagiene, 2011:1; Magana & Frenkel, 2009:1). UNESCO (2010:4), Bush and Mott (2009:5) and Hannum (2007:6) assert that in the 21st century no society would achieve its vision and mission without incorporating technology into every aspect of its daily responsibilities.

It follows that teachers' ICT competencies are the only constituents that would assist to develop learners to fit well within this information era. It is therefore imperative that this study investigates teachers' ICT competencies in order to suggest a strategy that could be used to effectively integrate computers in classroom practices. Goktas et al. (2009:194) emphasise that integration of ICTs enhances quality education, helps teachers to improve their pedagogical practices, and ensures that learners learn more effectively and improve their performance. The use of ICTs can undoubtedly improve the education system. For this reason, it was important for me

as the researcher to obtain views from various authors concerning the use of ICT from a South African perspective, which is the topic of the next section.

3.3 INTEGRATION OF ICT IN SOUTH AFRICA

3.3.1 South African e-Education policy

The integration of ICTs in the education system continuously poses a remarkable challenge both locally and globally. The South African education system, like any other country's education system worldwide, should be ready to respond to the numerous changes brought about by technology.

Numerous authors (for instance Blignaut et al., 2010:78; Howie, Muller & Paterson, 2005:125) have revealed that the majority of countries develop ICT policies in order to enhance teaching and learning but in most instances these policies are not being realised. This might emanate from the lack of knowledge on how ICT can effectively be integrated in teaching and learning. In South Africa, there is a well-designed e-Education policy, but the challenge is how to put it in practice. This challenge might be attributed to the education policy (curriculum) developers because of their limited knowledge of technology usage as well as a lack of information on matters pertinent to ICT implementation at grassroots level. Teachers' ICT competencies might be the sole contributory factors to why ICT integration is not well off the ground within the South African education system. This study therefore sought to investigate secondary-school teachers' ICT competencies.

According to the South African Department of Education's e-Education policy (2004:17), teachers were expected to assist learners to be technologically savvy by 2013. As of now there is no clear evidence that whatever is stipulated in the policy has been realised or whether it is in the pipeline to be realised. It is imperative that further researches should be conducted to find out how many South African schools have complied with the directive stipulated in the e-Education policy and why some schools were unable to act in accordance with the policy.

Laurillard (2008:7) claims that the advantage of having an educational policy is that it clarifies what needs to be done. Certainly, the South African e-Education policy has laid down what has to be done concerning the implementation of ICTs. It is true that some teachers have tried their level best to integrate ICTs in teaching and learning, but this seems to be a lengthy and daunting process. There is a body of research indicating that many teachers do not integrate ICTs in teaching and learning. It was within the scope of this study that I had to find out why the integration of ICTs seemed to be a lengthy process.

3.3.2 ICT researches in South African schools

South Africa and other countries participated in the study conducted by the New Partnership for Africa's Development (NEPAD) which revealed that 75% of secondary-school teachers had limited experience and expertise in the use of ICTs (Esharenana, 2010:3). According to these results only 25% of South African teachers are technologically savvy, which means there is a need in SA to equip teachers with ICT experiences and expertise that would enable them to provide learners with information-age opportunities.

In her study on the use of computers in secondary schools in South Africa, Naicker (2010:675) found that mobilising teachers to use computers in teaching and learning was a slow and tedious process. This author also discovered that many secondary schools' computer studies dealt with sophisticated educational programmes and computer resources, and gave inadequate attention to why teachers were not using computers in their teaching. The problem in secondary schools' curricula might be the offering of Computer Application Technology (CAT) and Information Technology (IT) as technology-integrated subjects. For this reason, most of teachers think that computer laboratories are meant for such subjects and are unaware that they can use computer laboratories to integrate ICTs in teaching and learning. This is one more reason why this study gives attention to why teachers do not use technology.

Blignaut et al. (2010:69) also conducted a study concerning the use of ICT, from the South African perspective. Their study showed that the integration of computers into teaching and learning in South Africa remained a considerable challenge. Equally

important, Isaac (2007:24) emphasised that in South Africa, infrastructure, human resources and ICT access strategies were a noteworthy concern that would potentially accelerate for some years to come.

In the study conducted by Ford and Botha (2007:2) concerning the use of ICT in teaching and learning in SA, the results highlighted the following issues as prevalent:

- lack of ICT-literacy at a general level amongst teachers;
- stringent and structured forms of teaching with little or no scope for lateral thinking; and
- realisation of the importance of technology but inability to incorporate this due to lack of training, adequate infrastructure and integration with the current curriculum.

Furthermore, in the same document these authors further commented that the focus on implementation of technology in schools was on ICT infrastructure and accessibility rather than the matters noted above. Learner-teacher ratio was also considered as a challenge in computer integration in schools because computer laboratories could only house 10-20 computers and this did not give teachers and learners enough opportunity to explore new teaching and learning ICT functionalities.

As an illustration, these documented contributions indicate that integrating ICTs in teaching and learning in South Africa is not yet at a pleasing standard. This prompted me to investigate secondary-school teachers' ICT competencies in order to suggest a strategy that could help teachers to use ICTs in their classroom practices. In this information age, integrating ICTs in teaching and learning unquestionably remain teachers' potential repertoire.

South Africa, just like all other developing countries, is struggling to get teachers to be highly skilled in a technological environment and to produce a technologically capable workforce. The only solution might be to find out how well or at what level teachers in SA are competent ICT users and then take it from that angle. In essence, ICT integration in South Africa seems to be a really demoralising experience. This might be caused by the fact that individual provinces were responsible for integrating

ICT in teaching and learning. Although there are some provinces that are doing well in the area of ICT usage or implementation, a greater challenge remains with the rural areas and other parts of the country that cannot afford the infrastructure. It therefore stands to reason that a great deal still needs to be done in South Africa.

ICT integration into teaching and learning is not an easy process to embark on. It is imperative that the needs of a country concerning ICT usage should be analysed before implementation. This is crucial because countries worldwide differ in terms of economic and social dispensations that contribute to technological innovations. The level of ICTs usage in South Africa (SA) would no doubt differ from the level of ICTs usage in the United States of America. Needs analyses would assist to gauge the level at which ICT integration in SA could be approached. With this in mind, all education stakeholders are expected to be involved in the decision-making regarding the implementation of ICT in teaching and learning .Such stakeholders include curriculum developers, curriculum implementers (teachers), education specialists, academics, the leadership in education fraternity and ICT specialists. It is necessary that all these people should collaborate to find a solution on how to integrate ICTs in teaching and learning. The South African National Curriculum might be a contributing factor for not embracing ICTs in teaching and learning. These issues are discussed below.

3.3.3 ICT and the South African National Curriculum

Ever since its inception, the new South African education system has undergone continual transformation. This might have caused a shift of focus in terms of the use of technology in teaching and learning. It should be noted therefore that the South African curriculum has not proven to be stable. In a statement made by the Minister of Education, Mrs Angie Motshekga (Department of Basic Education's Curriculum Assessment Policy Statement, 2011:1), she states that in 1997 Outcomes-Based Education (OBE) was introduced and there were challenges which led to the Revised National Curriculum Statement (RNCS) for grades R-9 and the National Curriculum Statement (NCS) for grades 10-12. In the same document, she comments that the review was made and led to the implementation of the NCS for

grades R-12. These refinements and changes to the curriculum might not have worked well for the country's education system because of the following reasons:

- training was done within a short space of time; and
- the misinterpretation of terms used in the curriculum.

At the time of conducting this study there was a newly implemented document, namely Curriculum Assessment Policy Statement (CAPS), which strengthened the current NCS. The amendment of the curriculum from time to time was worrying. For this purpose, the South African education system might have ignored other sectors that could have been employed to enhance teaching and learning, like for instance integrating ICTs in teaching and learning. What was happening was that the ICTs efforts were not seen to be a delivery mode through which the education system could be improved. A major concern is that technology is also changing over and over again. It is continually changing and leaves the mass of teachers behind because before they can master the existing technology, new tools are being introduced.

One other challenging and vital aspect facing the South African government is the future of its learners. As it is stated in the policy, they should be ICT savvy by 2013. This is inevitable, because 21st-century learners are expected to compete effectively with their counterparts within a rich technological environment. With this in mind, the South African education system has to take a new route and adapt to ICT usage as a matter of course or redesign it so that it places learners at the required standard of the 21st-century teaching and learning environment. There is also a need to look at what assistance SA acquired to integrate ICT in teaching and learning. The discussions follow below.

3.4 ICT INITIATIVES IN SA

As mentioned earlier on in Chapter One of this study, the following were some of the ICT projects initiated in SA that were geared towards enhancing teaching and learning (Wilson-Strydom & Thomas, n.d.:5; Butcher & Associates, 2011:31; Education Labour Relation Council (ELRC), 2010; Isaac, 2007:12):

- Intel® Teach programme
- the Khanya Project ;
- *GautengOnline*;
- Teacher Laptop Initiative; and
- Thutong portal.

A detailed discussion of each project follows below.

3.4.1 Intel® Teach programme

The Intel® Teach programme was launched in South Africa in 2003 (Wilson-Strydom & Thomas, n.d.:4). The overall aim of this project was to improve teachers' pedagogical practices through ICT usage and promote learners' 21st-century skills as well (Butcher & Associates, 2011:8). The approach was to train the trainer (Butcher & Associates, 2011:7). This was done through sending representatives from different provinces to be trained on how to use technology. Thereafter they were in turn expected to train teachers at their respective workplaces. Butcher and Associates (2007:6) note that few teachers managed to implement what they gained at the training sessions. This indicates that training might not have been done thoroughly or the approach might have been unsuitable for the needs of the entire group. The reason might be that needs analyses were not done to find out how teachers could be helped to integrate ICTs in their classroom practices. Teachers were trained on how to create assessment tools, and because of technology advancement, the focus shifted and was then based on ICT integration aligned to the South African NCS.

Weaknesses and challenges were experienced throughout the implementation process. The only strength reflected was the linkage between the project and the then new NCS (Butcher & Associates, 2007:5). In the same document, Butcher and Associates (2007:5) identify the following as challenges all provinces faced:

- staff shortages in provinces - in some instances one person was responsible for the whole province;

- budget allocation to support training - it was not an easy task for trained teachers to convince their schools to budget for ICT infrastructure;
- teacher training fatigue - the implementation of a new curriculum (NCS) went concurrently with the implementation of the project, hence teachers had to attend the Intel® Teach programme after hours when they were exhausted; and
- the roll-out of infrastructure and technical services impeded the successful implementation of the project.

The strength, weaknesses and the challenges discussed above indicate that training in ICT usage was not effectively done, hence a new approach on further teacher training on ICT usage is worth reviewing as it is expected to equip teachers with ICT competencies.

3.4.2 The Khanya Project

The Khanya project was established in 2001 by the Western Cape Department of Education aimed at enhancing the curriculum delivery by supplying computers to all Western Cape schools by the year 2012 (Isaac, 2007:12; Van Wyk, nd:1). According to Van Wyk (nd: 1), ‘’The Xhosa word Khanya means enlightenment’’. This means teachers and learners were supposed to gain exposure to ICT usage. The project focused on engaging technology’s power that would enlighten and broaden learners’ learning experiences and also provide educational opportunities that might not otherwise have been possible without ICT usage (Van Wyk, n.d:1).

Integration of technology in teaching and learning was the main emphasis. Two teachers who had exposure to ICT usage were trained to become Local Area Network (LAN) administrators (Van Wyk, n.d:2). They had to see to it that there were smooth networking operations. There were also Khanya facilitators who were assigned to different schools. These were teachers who had ten years teaching experience and were competent ICT users as well. They were expected to organise workshops in order to provide basic computer literacy skills involving the use of hardware such as keyboard, screen, printer and other peripherals (Van Wyk, n.d:5). Also included was the operation of application programmes such as some of the

Microsoft Office Suite, for instance Microsoft Word, Excel, PowerPoint Presentations and Access. To date, according to Van Wyk (n.d:5), teachers in Western Cape have received the basic training as far as the use of ICTs is concerned.

3.4.3 *GautengOnline*

Isaac (2007:12) conducted research on *GautengOnline*. According to him, the goal of this project was to develop learners' future skills through quality education. In the same document Isaac further contends that *GautengOnline* erected computer laboratories equipped with 25 workstations and all were internet and e-mail accessible. This project was based in Gauteng Province (GP) as the name implies and meant to assist the Gauteng teachers and learners only. At the time of conducting this research, the *Pretoria News* reported on 8 May 2012 that it was about eight years since this project was implemented but computer laboratories had not been built in every public school in Gauteng. In addition, the same newspaper reported that *GautengOnline* was not functioning economically, efficiently or effectively. When the audit was performed in 2010/2011, the results showed the following (Serrao, 2012):

- inadequate security measures;
- *GautengOnline* being offline;
- inadequate support and maintenance of equipment;
- a failure to replace stolen goods; and
- a failure to pay service providers on time.

Based on the information above, *GautengOnline* was a positive step taken by the South African government. Sadly, what is indicated above may be the result of poor management. Plans pertaining to *GautengOnline* should be revisited so as to ensure that teachers' ICT competencies are sharpened to get ready for 21st-century technological challenges.

To assist in providing the reader with the context of this study, the following map shows South Africa's nine provinces. According to the discussion above, the initiatives were positioned only in Gauteng and the Western Cape, while the Intel®

Teach Programme covered seven provinces, namely Gauteng, Western Cape, Eastern Cape, Kwazulu-Natal, North West, Limpopo and Free State.

Figure 3.1 South Africa's nine provinces adopted from go touch down travel and tours, 2013

Although information provided by authors (Isaac, 2007:12; Van Wyk, nd:1; Butcher & Associates, 2007:5) show that most of the provinces received some training in ICT integration in teaching and learning, the question remains whether all schools that were involved in this whole process of technology training put into practice this ICT skill. These projects aimed at training teachers on how to integrate ICTs in teaching and learning. However, training of teachers might not have been thoroughly done, because when they went back to their respective schools most of them did not practice what they had gained at training. This may be the result of lack of infrastructure or financial constraints. Again, training may however have lost sight of other issues affecting effective ICT integration, for example preparing the school environment, parent involvement, ensuring security, follow-up sessions to ensure continuity, and checking on the challenges that teachers in particular may encounter

in the process of integration. All these failures could be attributed to poor management.

Pearlman (2009:19) emphasises that engaging ICTs in teaching and learning cannot be done in piece-meal fashion; there is a need to work together to consider learners' 21st-century skills as an integral aspect in the use of ICTs in teaching and learning. It must also be noted that the availability of infrastructure in schools does not necessarily mean integration of ICTs in teaching and learning is taking place. Infrastructure only forms part of what is expected to enable an effective integration of ICT in classroom practices. More initiated projects are needed because South Africa has nine provinces and some of the above-mentioned projects were based only in certain provinces and not within the entire country. This shows how some provinces missed out on the opportunity.

3.4.4 Teacher Laptop Initiative

This new project was introduced at the time of conducting this study, namely Teacher Laptop Initiative (TLI). The project was intended to equip teachers with ICT skills. What was worrying was that not all teachers qualified for its subsidy. According to the Media release on 13 July 2010, site managers of schools were priority number one in receiving laptops. Worst of all, the project was put on hold for some other matters that needed to be finalised. While the provision of laptops would had lessened infrastructure accessibility barriers for teachers, learners would be left without these tools. The author (Laurillard, 2010:63) has shown that the use of ICT would help teachers to develop learners' 21st-century skills. The TLI project would therefore limit learners' interaction with ICT tools and obviously learners' 21st-century skills would never be developed. The TLI project was a good shift to be pursued in South Africa, but a research project would have to be conducted to find out how well the project has assisted to develop teachers' ICT competency.

3.4.5 Thutong portal

The Thutong portal was yet another project in South Africa which aimed at developing teachers' pedagogical practices to enhance teaching and learning

through the use of ICTs. It was reported to be working well as an online community's technology tool (Butcher & Associates, 2011:32). Teachers were expected to access it and use ICT tools like for instance discussion forums and blogs for guidance, sharing resources and their experiences in the use of ICTs.

The Thutong portal also assists teaching and learning in the following ways (Butcher & Associates, 2011:32): it

- contains teaching and learning support material;
- administers and manages resources;
- provides tools for schools;
- renders accessibility of education policy documents; and
- provides general news and information related to education system.

The fundamental issue is how many South African teachers gain access to it. Let alone visiting it, how many of them are aware of its existence. Accordingly, there is a need to conduct research to find out how many teachers benefit from its usage through enhanced ICT competencies. The challenge could be the lack of knowledge and skill on how to access its functionalities.

At least there is evidence in SA that the use of ICTs is considered as a priority at national government policy level. It is clear that the education system has a well designed ICT integration policy framework. However, how this policy should be implemented is certainly of concern. The degree of implementation varies greatly, ranging from no evidence of implementation in some schools, to a shaky implementation in some, to full implementation in some. The evidence provided by different authors mentioned above indicates that ICT integration in teaching and learning is a continuous effort that requires examining teachers' ICT competencies. In the South African context, this might be failing as a result of a strategy that has not been well designed to equip them with ICT competencies. All in all, the discussions about different initiatives show that there is a pressing need in SA to train teachers on how to integrate ICTs in teaching and learning. The following paragraphs give clarity on ICT competencies investigated in this study.

3.5 ICT COMPETENCIES

According to Goktas et al. (2009:277) as mentioned in Chapter One, competency is the state or quality of being well qualified to perform a task. UNESCO (2011:90) defines competency as the skills, knowledge and understanding needed to do something successfully. In the context of this study, teachers are expected to showcase their potential to effectively and efficiently perform their duties through the use of ICTs. As such, they require resources that would enable them to enhance teaching and learning. Desjardins et al. (n.d.:214) and Baron (n.d.:25) in their studies distinguished four kinds of ICT competencies, namely *technical, informational*, *social and epistemological*. Other authors such as Goktas et al. (2009:277) refer to them as ICT *knowledge, skills and attitude*. The next section provides a brief discussion of what each competency entails (Desjardins et al., n.d.:214):

3.5.1 Technical competencies

The *technical competency* involves the basic operation of computers which is knowledge of computers and how to use them. For example, teachers are expected to operate different application programs like word processing in order to create, edit or format a document, teach learners how to do Maths calculations using formulae in spreadsheets, or present a lesson through the PowerPoint application programme. Furthermore, the technical expertise of trouble-shooting is essential to ensure the smooth operation of computers. In this instance a teacher would be expected to identify an error, for example when a computer quickly switches itself off without any warning. A teacher should be able to identify and solve such a problem without asking any assistance from a school's ICT coordinator. This encompasses modelling ICT technical competency expertise.

3.5.2 Information competencies

Information competency entails teachers' ability to draw relevant information or surf a variety of search engines available on the internet (Desjardins et al., n.d.:214). The internet contains robust search engines and educational websites to which teachers

can gain access to prepare their lessons. The following are examples of some search engines, according to Shelly et al. (2010:132-134):

- A to Z Educators contains educators' stuff pertaining to different subject areas. Educators are advised to check it for relevant information for their learning areas;
- Google for Educators contains countless sources for teaching resources, everything from blogging and collaborative writing to geographical search tools and 3D modelling software. This allows educators to let learners stop imagining what is happening worldwide but to study the world in a real-life situation; and
- Learning page allows educators to brows collection of learning materials. They are also advised to download lesson plans, books, and many other materials.

In addition to the above-mentioned websites, if teachers are ICT competent users, they would go to the extent of designing their own websites and ask learners to visit the website for reference purposes. Search engines and educational websites provide learners with opportunities beyond the four corners of their classroom walls. They can learn anywhere, anytime, as long as they are connected to the internet. This is why teachers' ICT competencies are essential in this information age; their competencies would in turn make learners aware of the potentialities of ICTs.

3.5.3 Epistemology competencies

Epistemology competency involves capitalising on the use of technology to solve a problem, or to rely on what technology can do to treat information in a variety of ways in order to accomplish the lesson outcomes and assessment standards (Desjardins et al., n.d.:214). In some instances teachers would be obliged to rely on the use of ICT in order to achieve lesson outcomes. In the South African NCS there are some lesson outcomes and assessment standards that cannot be achieved without the use of technology, hence teachers have to rely entirely on the use of technology software to achieve them. For example, in Geography the lesson outcomes for Geographical Information Systems (GIS) won't be realised without the

use of technology. This topic was included in Geography when the new curriculum NCS was introduced in South Africa. The software firstly had to be installed in a computer, and as the process unfolded the learners would be granted the opportunity to explore geographical features by just a click of a mouse. In this way, learners experience and watch geographical features they usually read about in their books. They no longer imagine what geographical features look like but view them in a real-life situation.

Technology has brought whatever used to be inaccessible within a reach. There are multitudes of educational software which teachers can use to attain the lesson outcomes. In Life Science, teachers can use Microsoft Encarta software to let learners explore the functionalities of the human heart. This can be a very interesting learning experience as learners explore how the heart functions in a real-life situation. What is essential is teacher's ICT skill on how to use this software. This once more emphasises the acquisition of teachers' ICT competencies, which seem to be a vital ingredient in the 21st-century education system.

3.5.4 Social order competencies

Social order is the ability to interact and communicate with global communities through the use of ICT (Desjardins et al., n.d.:214). There are social networking websites which are used for this purpose. For example, the most visited social networking websites are Facebook, Twitter, WhatsApp and Mxit. Most learners use these sites for their personal interests. Teachers are expected to make them aware that they can benefit a lot from these social networking tools. They can share ideas, review the work done during the day at school, or even make comments on resources placed online. Moreover, these social networking tools are quick and user-friendly. Learners can share an updated wealth of information. Now let's assume that these sites are used for educational purposes, there is no doubt that learners' performance would be improved. Again, learners can use communication tools such as e-mails, mailing lists and chat rooms to share ideas and their educational frustrations (Kwache, 2007:396).The secret of how to use these tools rests with teachers' ICT competencies. Teachers are expected to guide learners on how to use

them fruitfully. However, if they are not competent ICT users, learners would be confused or lost. It is noteworthy to look at authors' views concerning teachers' ICT competencies as presented below. The UNESCO ICT competency framework for teachers is worth noting.

3.6 THE UNESCO ICT COMPETENCY FRAMEWORK FOR TEACHERS

UNESCO has developed an ICT Competency framework for teachers which could place teachers at a level or standard that would make them re-shape the education system effectively. UNESCO's ICT competency framework for teachers embraces three phases (UNESCO, 2011:3) namely: *Technology Literacy, Knowledge Deepening* and *Knowledge Creation.* The three phases harness the education system to produce informed citizens that who support economic, social, cultural, and environmental development, as well as improved standards of living (UNESCO, 2011:8). The framework is intended to equip educational policy makers, teacher-educators, providers of professional learning and working teachers with ICT usage that can transform the education system at large (UNESCO, 2011:3). This framework not only focuses on teachers' ICT competencies but also develops learners' 21st-century skills. Clearly, it draws attention to various ways that can be used to transform the education system. Teachers are expected to take a lead in realising the aims and objectives of this framework.

The following table shows what is included in each phase, followed by a brief discussion and keeping in mind the South African stance as a matter of concern.

Table 3.1 The UNESCO ICT competency framework for teachers (adapted from UNESCO, 2011:3)

THE UNESCO ICT COMPETENCY FRAMEWORK FOR TEACHERS			
	TECHNOLOGY LITERACY	**KNOWLEDGE DEEPENING**	**KNOWLEDGE CREATION**
Understanding ICT in education	Policy awareness	Policy understanding	Policy innovation
Curriculum and assessment	Basic knowledge	Knowledge application	Knowledge society skills
Pedagogy	Integrate technology	Complex problem solving	Self-management
ICT	Basic tools	Complex tools	Pervasive tools
Organization and administration	Standard classroom	Collaborative groups	Learning organizations
Teacher professional learning	Digital literacy	Manage and guide	Teacher as model learner

3.6.1 Technology literacy

In this first phase, UNESCO suggests the implementation of policy goals. This point emphasises that from the outset teachers should be made aware of the existence of

ICT policy and be encouraged to make it feasible. ICT policies at large provide an overview of the use of ICT in the education system. In South Africa, as mentioned earlier in this chapter and also Chapter One, there is a well-structured e-Education policy, but the only challenge is how to implement it. Howie et al. (2005:125) and Blignaut et al. (2010:78) confirm this, indicating that most of countries have well-designed ICT policies but the implementation thereof is less likely to happen (refer to 3.3.1). SA is no exception. It has no choice but to revisit its policy and iron out the barriers that might hinder its implementation.

Included in this first phase is the basic knowledge of curriculum and assessment, which enables teachers to choose an appropriate technological tool to facilitate the achievement of learning outcomes. UNESCO (2011:9) concurs with this notion by indicating that the integration of ICTs in teaching and learning should be linked to appropriate curriculum context. This necessitates the addition of extra minutes in subjects' delivery execution time. These additional minutes should be made available to accommodate hands-on technology.

Pedagogy is the other aspect that falls under Technology literacy. The use of technological devices would undoubtedly change pedagogical practices. This means teachers should be able to choose an appropriate technological device that can be used in conjunction with a particular method to support the achievement of learning outcomes. As a matter of fact, the implication thereof points to teachers' ICT competencies. Being ICT competent users would obviously enhance their pedagogical practices.

UNESCO's framework also reflects teachers' knowledge of ICT basic tools. This implies the ability of teachers to identify appropriate ICT tools that would enable them to achieve learning outcomes. Certainly, they are not expected to know them as for example application programmes, the internet, or Google search engines, but should also know exactly when and why to employ them in their classroom practices. As mentioned earlier in this chapter, the concern is that before teachers master the current tools, new ones are being introduced.

Another aspect of UNESCO's framework is organization and administration. Organization and administration plays a vital role in integrating ICTs in teaching and learning. This echoes the argument made by the author (Pearlman, 2009:19) in this chapter that implementation of ICT in teaching and learning should be approached by education stakeholders together as a team. In many instances, as mentioned in this study, the whole process turns out to be a failure because teachers are not guided and left to their own devices. This might also be the case in the South African context. The whole idea behind this aspect is to ensure continuity, assistance, and collaboration to overcome the challenges that might obstruct the ICT implementation progress.

Teachers' professionalism has been mentioned several times in this study. In essence, this was the focus of this study, namely professionalism in terms of their ICT competencies. This idea reflects back to the training of teachers in the use of ICTs in teaching and learning. South African teachers, as indicated in this study, are not yet well versed in the use of ICTs in teaching and learning. The reason could be that most of them were born before technology and are referred to as digital immigrants and as such are afraid to engage ICTs in their classroom practices. Worst yet, their learners as digital natives are pace setters in manoeuvring ICT functionalities.

3.6.2 Knowledge deepening

This phase necessitates equipping teachers with skills that would enable them to produce learners who could plough back by participating fruitfully within a society. Teachers play a major role in this instance which is to dig deeper and gain knowledge of what it is that technology has to offer them. The literature review has established that various authors (Blignaut et al., 2010:69; Esharenana, 2010:3; Naicker, 2010:675; Isaac, 2007:24) believe that most of South Africa's teachers are not yet at the knowledge deepening phase, let alone knowledge creation. Although these authors do not explicitly refer to these phases, their arguments highlight the fact that SA is lagging behind. Although it is not advisable to compare South African

ICT levels with those of other well-off countries, SA should start somewhere. These authors further contend that SA still has a long way to go.

UNESCO's ICT framework and the ICT competency framework cited by authors in this study share common sentiments. The operation of different technological devices and pedagogical practices are geared towards the same outcomes. According to UNESCO (2011:16), this framework would help teachers to turn around the education system. In the same document, UNESCO suggests that countries that might be interested in implementing this framework should from the outset conduct baseline research to find out their teachers' level of ICT competencies and then take it from that angle. The baseline research would assist different countries to choose phases that are suitable for their teachers. This leads to the concept of teachers as change agents in the education system. Their approaches to this educational paradigm shift and also their standpoint is a priority in the education fraternity.

3.7 TEACHERS AS CHANGE AGENTS IN THE EDUCATION SYSTEM

Teachers are regarded as the key persons in every educational environment (Ololube, 2006:103; UNESCO, 2011:18). They play a pivotal role in the education system and, in particular, in the integration of ICTs in education. Technology has brought new sources of information and tools that teachers can employ to enhance teaching and learning. What raises concern is that the 21st-century learners get acquainted with the use of ICT more quickly than their teachers. However, learners' quick knowledge of diverse ICT tools is not linked to educational purposes but to their social agendas. Teachers should change learners' attitudes about the use of these tools and show them how to gain from their use.

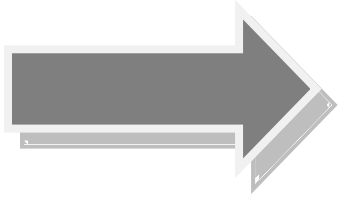
UNESCO (2011:5) emphasises that 21st-century learners need to be assisted to acquire content knowledge of a subject but also to construct knowledge through the use of technology. For most teachers, this is a big challenge because the use of ICT was not included in their teacher training programmes (Tropakci, n.d.:1; Afshari,

Bakar, Luan, Samah & Fooi, 2009:89). Consequently, this could cause anxiety and demoralise them in the quest to engage ICT in teaching and learning.

As mentioned in Chapter One of this study, the effective and efficient use of ICT would not only enhance teaching and learning but would also develop teachers' pedagogical practices. As such, a solid foundation should be laid at pre-service training institutions and refresher seminars or workshops at in-service training institutions. Most teachers entered their careers before the advancement of new technology, hence there may be a need to re-imagine and re-shape teacher training programmes for prospective teachers in order to be on par with new teaching and learning developments of this information age. This warrants more research to be conducted to find out what it is that higher education institutions are doing to prepare prospective teachers for technological challenges. The use of ICTs also forces a change in teachers' roles. They are not expected in the information age to use similar teaching and learning approaches to those they used in the 20th century.

The following table indicates how teachers' role should be transformed in the 21st-century teaching and learning environment (UNESCO, 2010: 6).

Table 3.2 Change in teacher's role (Adapted from Resta and Patru 2010).

Change in teachers' role		
A shift from		to
knowledge transmitter		learning facilitator, collaborator, coach
primary source of information		knowledge navigator and co-learner
teacher controlling and directing all aspects of learning		teacher giving students more options and responsibilities for their own learning

The above table indicates that teachers in the 20th century were regarded as knowledge transmitters whereas in the 21st century they should become facilitators or collaborators in learning experiences. They are no longer regarded as primary sources of information but knowledge navigators and lifelong learners. They also find themselves giving learners opportunities to be actively involved in their learning and not as passive recipients of information. All the same, teachers' roles have experienced a paradigm shift and this would be for the best education system that has ever been experienced globally. Teachers as facilitators and mentors should develop learners' critical and creative thinking skills through collaborative learning environments. As resource and technology coordinators, they have to develop learners' 21st-century skills through multiple resources brought by technology (Makrakis, 2005:3).

Integration of ICT into teaching and learning would not be realised unless teachers are trained to facilitate the whole process. Facilitation in this instance could be relying on teachers and believing in their efforts to transform the education system. As such, they should be entrusted to perform their duties diligently. Perhaps this would motivate them to explore ICT functionalities to find out how ICT can harness teaching and learning.

Teachers certainly find it challenging to effectively integrate ICTs in teaching and learning. Moreover, they are the only constituents that could develop learners' 21st-century skills (Laurillard, 2010: 63). This poses a thorny challenge to them, more especially since they may believe that technology has made teaching more complex. Now is the time to take into cognisance the fact that teachers need courage and motivation to be competent ICT users. Interestingly, digital natives (21st-century learners) seem to be more competent than their teachers in technological functionalities (Cornu, 2010:11). UNESCO (2010:2) echoes the same sentiment, further asserting that digital natives are so glued to the use of technology that they can hardly switch off their cell phones because in most instances they are constantly connected to the cloud. Interacting with technological devices is part of their daily activities. They cannot get enough of what technology provides them with; instead,

they keep on exploring devices and of course put their ears on the ground to be the first to get acquainted with new, updated available devices.

Teachers' doubts or rather rejection of education transformation are outwardly expressed in the form of computer phobia caused by an ever changing curriculum. As noted earlier in this chapter, education policy or curriculum changes from time and time. Very few teachers may adapt to these changes; most of them do not cope because of rapidly changing technology and are left behind or worse still, some may have no choice as they are trapped in their careers (Phelps & Graham, 2008:126). Hence, they tend to believe in their traditional teaching and learning approaches without attempting to engage technology in their classroom practices.

Goktas et al. (2009:277) assert that the demand for teachers with high ICT competencies is increasing. As repeatedly mentioned in this study, this has been caused by new information and knowledge brought by technology. To embrace ICT in teaching and learning is no longer an option for teachers but a must (Mills & Roblyer, 2006:6). Teachers need to be provided with the opportunity to do hands-on technology as part of their professional development so that they become competent ICT users in teaching and learning. Unless teachers are sufficiently and properly trained in computer integration, the tool will not be used or have no value at all. Undoubtedly, teachers' ICT competencies are vehicles that can be used to transform the education system. Equally important, teachers need to be helped to discover how ICT can unbelievably transform the education system through their pedagogical practices which would enable them to develop learners' 21st-century skills.

Teaching has basically become a new profession and learning is also changing as digital natives have brought new challenges to teachers. The following are the new challenges for teachers, according to UNESCO (2011:17):

- teachers have to consider the new characteristics of 21st-century learners in order to be aware of their new abilities and to respect their new relationship to learning;

- they should be well conversant with the new curriculum that contains complex and transverse components. They must be aware of a school's mission and the societal values the school has to transmit;
- they have to be familiar with networking, because their roles are to develop human networks for learning;
- teachers must work collectively with their colleagues. This will help them develop collaborative activities. Schools in the 21st century need collectively intelligent teachers;
- they are expected to be e-teachers. This implies not only integrating ICTs in teaching and learning, but also developing their pedagogical practices in respect of technology;
- they also have to be blended teachers. This means that they have to make use of all possibilities offered by technology;
- teachers have to be lifelong learners so that they can develop learners to be lifelong learners as well; and
- teachers should be awarded opportunities to participate in the new policy-making decisions as they are regarded as change agents in education system transformation.

As noted above, teachers should embrace these challenges because the use of technology in this information age might reach a point of no return. By virtue of noted evidence voiced by different authors, it is true that without teachers' ICTs competencies the use of ICT in classroom practices would be problematic. It is crucial for teachers to be ready to participate in this educational paradigm shift. Regardless of how sophisticated ICT might be, it will never be practiced unless teachers are ready to do so. It is also essential to look at how teachers are expected to engage with it, which is discussed below.

3.8 HOW TEACHERS ARE EXPECED TO INTEGRATE ICT IN TEACHING AND LEARNING

3.8.1 Examples of ICT integration tools

The rapid spread of technology has given rise to the availability of numerous ICT tools. These tools provide exciting opportunities that could have been a challenge for the education system to accomplish without ICT. However, teachers are expected to be ICT-competent users in order to facilitate technology-integrated lessons. They are expected to channel learners towards the appropriate use of ICT tools.

Shelly et al. (2008:330) suggest the following steps for a successful technology-integrated lesson:

The teacher should

- firstly, identify specific standards within the curriculum that need to be realised;
- secondly, set lesson objectives;
- thirdly, identify appropriate technology tools that will enhance teaching and learning; and
- lastly, develop innovative ways to teach diverse populations of learners with different learning styles.

For successful integration of ICT in teaching and learning, teachers should be advised to consider the above-mentioned steps when preparing a technology-integrated lesson. What Shelly et al. highlight is similar to the unique knowledge depicted by the TPACK conceptual framework provided in Chapter Two of this study. Different authors have identified various technological tools that can be used to enhance teaching and learning.

The following table represents tools which are repeatedly mentioned by different authors as tools that play a vital role in a meaningful integration of technology in classroom practices: (UNESCO, 2010:14; Pearlman, 2009:15 & 19 ; Scardamalia, 2008:3; Shelly et al., 2008:329, 334 & 336; Hew & Thomas, 2007:223; Hannum, 2007:12; Casserly, 2007:16; Daley, 2007:7; Ficek & Segovia, 2006:30 & 33; Jones-Kavalier & Flannigan, 2006:9)

Table 3.3 Integration of ICTs in classroom practices

Technology tool	**Purpose**	**Integration in Teaching**
Word processor	It is used to create documents and can also improve learners' writing and editing skills.	Teachers can instruct learners to write their assignments or tasks in a presentable manner using a word-processing application program.
Graphic presentation/Power Point	It is used to convey ideas or information through slides.	It is user-friendly in presentation of a technology-integrated lesson. Teachers can make a technology-integrated lesson more interesting by inserting graphics, animations and pictures linked to the theme under discussion.
Internet/WWW	The internet is regarded as a vast information resource, it connects users and the same information is accessible worldwide. Transports learners to the	Teachers do research on the internet for reference purposes; a teacher can also create his or her website and ask learners to access it for further information.

	world beyond their classrooms.	
E-mails, blogs, podcasts, instant messaging	These tools help learners and teachers to communicate from various geographical locations.	These tools encourage the sharing of scholastic information among learners and teachers as well.
Wikipedia	Learners are encouraged to participate in knowledge sharing through these tools.	The use of these tools promotes collaboration and creativity among learners; creativity in terms of sharing information of a certain task through wikis. Teachers can also upload instructional materials on wikis for learners to refer to.
Computer	A computer is a hardware technological tool that performs four basic operation functions, namely input, output, processing and storage of information.	Teachers are expected to teach learners how information is processed within a computer. Also, how to install software in a computer and many other technical competencies mentioned earlier in this chapter.
Interactive white boards	The interactive whiteboard is a touch-sensitive screen connected to a computer.	The interactive whiteboard promotes active participation among learners. Learners get the opportunity to explore teaching materials through touching the white board, using a digital pen

		or a remote control.
Classroom control software	This software is used to manage or control learners in the use of computers.	This software enables teachers to see learners' progress in their workstations. A teacher is also capable of deactivating functionalities if learners tend to abuse them.
Microsoft Encarta software	This is an interactive multimedia encyclopaedia	Applications such as these enable learners to build a cognitive scaffold, which involves sharing of complicated terms and assisting each other to get clarity about them.
Digital media tools	Allows learners to have learning experiences in which the concepts are brought to life with a variety of representations, video, sounds, colours, simulations and animations.	With digital media tools teachers can expose learners to activities that are in a real-life situation.
Newer mobile phones or smart phones	Mobile tools contain functionalities used not only to chat and send text messages but include images and videos that deliver everything from	Teachers have a broad choice to engage technology in teaching through mobile tools. For example, they can send text messaging or instant messaging concerning the tasks done in

	internet searches, to sending and receiving emails, street maps and the weather.	classrooms. Engage learners in sharing information through emails, blogs and chat functionalities.

Given the above information, ICTs provides various unique opportunities that can be used to approach teaching and learning (Shelly et al., 2008:336). Regarding the use and availability of ICT devices, the important question is whether teachers really know how to engage them in a technology-integrated lesson. It is evident from the above table that teachers have an enormous choice of technological tools to harness in teaching and learning. Optimum use of these broad choices entirely depends on the unique knowledge that teachers acquire in order to effectively integrate ICTs in teaching and learning.

A proper technology-integrated lesson allows learners to understand the concepts more clearly and learn no matter who or where they are (Shelly et al., 2008:336). Indeed, the use of ICTs would alleviate teachers' difficulties in explaining complex concepts as they can rely on technology to solve problems. Furthermore, learning is not limited to the four corners of a classroom but the use of ICTs offers the opportunity to learn anytime, anywhere if they so wish. The following table is an example of a technology-integrated lesson that teachers are expected use as a route to deliverer subject matter.

3.8.2 Example of a technology-integrated lesson plan.

Table 3.4 Technology-integrated lesson plan

Grade level	10
Subject/learning area	English
Learning outcome	LO 3.Writing and presenting (DoE NCS, 2003:32)
Assessment standard(s)	• Experiment with format and style for creative purposes. • Improve coherence and cohesion in overall structure. And • Prepare a final draft by proofreading and editing. (NCS, 2003:32)
Lesson topic	Formal letter
Lesson outcomes	At the end of the lesson learners should be able to: • Explain what is meant by a formal letter. • Type a formal letter using a word-processor application program. • Compare a formal letter and an informal letter.

Scenario	A grade 10 learner applies for a personal assistant vacancy at Caroline Secondary School.	
Technology integration strategy	Teaching strategy	Cooperative learning and direct instruction.
	Technology and other resources	Computers connected to internet. Word-processing application program Data projector Grade 10 English book (English Handbook and study guide) PowerPoint application program
	Teaching activities Explore learners' prior knowledge by asking them different modes of communications they are familiar with and how they are used in real life.	Learning activities Respond by providing different modes of communication and how they are used in real life.

	The teacher explains the formal letter and requests learners to access a web browser to search for more information concerning formal letters; The teacher asks learners to find the difference between formal and informal letters and prepare feedback through the PowerPoint application program.	Learners access web browser and search for more information concerning formal letters Learners find differences between formal and informal letters and prepare a slide presentation through the PowerPoint application program.
	Learners are given time to present feedback on their findings through the PowerPoint presentation program.	Learners present feedback on their findings through the PowerPoint presentation application program.
	By means of a word processing application program the teacher further explains and shows learners how to type and format a formal letter.	Learners observe the teacher and ask questions for clarity.
	The teacher asks learners to type and format a formal letter.	Learners type and format a formal letter.

Assessment	Learners are given tasks to apply for grade 12 admission at Kelapile Secondary School. They are also requested to use a word processor to type and format a formal letter. The teacher uses a rubric to assess learners' work. Learners are also requested to read their English book page 77-79 for enrichment and their task.

The planning a technology-integrated lesson differs completely from planning for a traditional approach to teaching and learning. These two approaches differ in terms of identifying an appropriate technological tool, formulating lesson outcomes that match the use of technology and employing a teaching strategy that is linked to the use of technology. When preparing a technology-integrated lesson, the following should be born in mind:

- decide on a lesson topic: this topic should be NCS compliant;
- identify learning outcomes and assessment standards: there are various learning outcomes and assessment standards prescribed in the curriculum. Teachers should be very careful in choosing learning outcomes and assessment standards. Both should be linked to the lesson topic. However, the learning outcomes inform the assessment standards and they are both constructed by the curriculum developers. The learning outcomes and assessment standards in the above lesson plan have been adapted from the South African NCS for the subject English.
- identify lesson outcomes: lesson outcomes are the responsibility of a teacher of a particular subject. I have developed the lesson outcomes illustrated in the above table as I am a former grade 10–12 English teacher. In a technology-integrated lesson, a teacher should ensure the inclusion of a technological tool. This is extremely important because the focus in this lesson plan is to witness the use ICTs in lesson delivery.

- the choice of a scenario: a scenario in a lesson plan gives learners the feeling of a real-life situation. Learners are enabled to associate what they learn in the classroom with a real-life situation, not something imaginary. Teachers should always strive to contextualise subject matter.
- decide on a teaching strategy: this is a method that a teacher uses to accomplish the lesson outcomes. It also determines the type of teaching and learning activities that should be prepared for lesson delivery.
- selection of technological tools and other resources: a technological tool should be appropriate for the lesson topic and lesson outcomes. This tool should play a role of enhancing the achievement of lesson outcomes. In a technology-integrated lesson the appropriate choice of a technological tool is the core of presenting a lesson effectively.
- teaching and learning activities: teaching and learning activities should be linked to a teaching strategy. In essence, a teaching strategy informs teaching and learning activities. The teacher as a facilitator gives a directive to learners and they are expected to respond in a lesson presentation. In other words, these two activities have a close relationship; learning activities depend on teaching activities. The use of a technological tool should prevail in both activities. In this study I observed how teachers engaged technological tools in their lessons presentations.

All in all, a lesson topic, lesson outcomes, assessment standards, a teaching strategy, teaching activities and learning activities should be intertwined and enable a logical flow of the lesson delivery. All the above reflections should be taken into cognisance in planning a technology-integrated lesson. Emerging from the views considered above, the next section offers some concluding remarks.

3.9 CONCLUSION

In this chapter, a literature review has highlighted that the use of ICTs can promote economic growth and, most importantly, paves the way for learners' bright future. In most countries, the uses of ICT policies provide a starting point for integrating technology in teaching and learning. Unfortunately, in most instances what has been

stipulated in policies has not been accomplished. In SA initiatives were geared at implementing ICTs in teaching and learning. Sadly, each province had to see to it that this implementation be realised. As a result, some provinces were denied the opportunity to explore technological potentialities. This chapter has also highlighted the UNESCO ICT competency framework for teachers. It is noteworthy that their teachers' competency framework is similar to other authors' ICT competencies.

It goes without saying that teachers are the panacea in the effective transformation of the education system through ICT usage. Their slowness in adopting ICT usage warrants intensive support from all education stakeholders. The use of technology in SA need to be re-imagined in order to ensure that South Africans matches the 21st-century standards that are envisaged by the new information era. This would encourage collegial exchange of ICT experiences locally and would hopefully achieve what is required in the 21st-century teaching and learning fraternity globally.

CHAPTER FOUR
RESEARCH DESIGN AND METHODS

4.1 INTRODUCTION

This chapter gives an overview of the paradigm stance that is appropriate for this study. Then it presents and motivates the logical choices made in research methods and design that enabled me to address this study's research problem. The elements of this research design include the qualitative research method, the case study design, the ethical considerations, the target population that was sampled, data collection strategies, how the collected data was analysed and measures to ensure trustworthiness. All these elements perform different tasks which contribute to the achievement of the purpose of the study and the answering of the research questions. The next section provides a brief discussion of the study's research paradigm.

4.2 RESEARCH PARADIGM

A research paradigm represents the fundamental assumptions and practices that influence how to conduct a research project from the way of shaping and understanding the phenomenon (Creswell, 2007:19). This study was underpinned by the interpretive epistemological paradigm. Researchers who take this stance seek to understand the world they live and work in (Creswell, 2007:18). They develop subjective meanings of the experiences directed to certain objects (Wahyuni, 2012:70). The understanding of the phenomenon is achieved through the direct interaction between the researcher and the participants (Wahyuni, 2012:70).

Furthermore, such researchers tend to rely heavily on the participants' views of the phenomenon under investigation (Creswell, 2007:18). In terms of this study, secondary-school teachers' ICT competencies in classroom practices were better

understood through my direct interaction with participants at their workplaces. I categorised my research questions as follows; the first question was for the semi-structured interview data gathering strategy and was geared at collecting data about how secondary school-teachers use ICT in classroom practices. The focus was on how they used computers and other related technological devices to enhance teaching and learning. The second question was used for non-participation observation and the focus was mainly on hands-on technology. The participants showcased their ICT competencies through technology-integrated lesson presentations. My intention was to find out what challenges they experienced when they integrated ICT in classroom practices. The last question was based on document analysis. I focused on the support that secondary-school teachers received to effectively integrate ICT in classroom practices. My gathering of data also relied on their shared experiences concerning the use of ICTs in their classroom activities. The research design below further outlines how the paradigm influenced this study.

4.3 RESEARCH DESIGN

A research design is a logical blueprint or plan that is used by a researcher to address the intended research questions (Babbie & Mouton, 2012:74; Yin, 2010:75). In other words, a design in a study is like a pathway that a researcher pursues until a predetermined destination is reached. Yin further emphasises that the logic in the design assists to strengthen the validity and the accuracy of a study. For him the logic involves (Yin, 2010:76):

> The links among the research questions, the data to be collected and the strategies for analysing the data so that the study's findings will address the intended research questions.

In addition, Anderson (2009:151) emphasises that the researcher is expected to explain and justify the choice of the research design and how it was employed. It is in this context that I believe that a researcher should be well conversant with the methodology and accountable for every step that is taken throughout the

implementation of the research plan. The qualitative research approach kick-starts the procedure that was embraced in this study to achieve the purpose of the study.

4.3.1 Qualitative research approach

Royse (2008:271) notes that when the researcher wishes to get a deeper understanding of the phenomenon under scrutiny he or she employs a qualitative research approach. Anderson (2009:137) and Creswell (2007:37) add that in a qualitative research approach, the researcher seeks to discover real-life experiences of individuals in relation to a particular problem in their own environment. As this study was empirical, I sought to get a deeper understanding of the secondary-school teachers' ICT competencies through their views, words and the rich descriptions of their ICTs usage, their lived experiences and the meanings they attached to them. Consequently, the qualitative research approach was best suited to provide the relevant information I desired. The use of qualitative research has also provided me with the opportunity to hear silenced voices pertaining to the use of ICTs in classroom practices.

McMillan and Schumacher (2010:322) give a different perspective about the use of a qualitative research approach; they say that in qualitative research a researcher enters the natural setting assuming that nothing is unimportant. This implies that all the immersions within the fieldwork should be recorded as they are vital and contribute to a better understanding of a problem. I collected data in this study and concurrently recorded the reflections of each data collection strategy. In keeping with McMillan and Schumacher, the idea was to capture everything possible that could contribute to the achievement of the purpose of this study and answering the research questions.

Creswell (2007:39) supports what the above authors indicate concerning the choice of a qualitative research approach, and builds on the following characteristics of this approach:

- The data is collected in natural settings where participants experience the problem under study. In this study the natural settings selected were four

secondary schools within the Bojanala District from which teachers volunteered as participants.

- The researcher is the key person who collects data through examining documents, observing and interviewing participants. As a researcher in this study I personally collected data through semi-structured interviews, non-participant observation and document analysis.
- The researcher always uses multiple sources of data collection strategies. I used three data collection strategies as mentioned in the previous bullet above.
- In qualitative research there is a theoretical lens through which to view a problem. TPACK and Connectivism were the lenses through which secondary-school teachers' ICT competencies in classroom practices were viewed.
- Qualitative research is the form of inquiry in which researchers interprets what they see, hear and understand. After the collection of the data, I interpreted and made meaning of all that transpired in the fieldwork pertaining to secondary-school teachers' ICT competencies.
- A report involves multiple perspectives, identifying the many factors involved in the situation and generally sketching the larger picture that emerges. The reported findings in the next two chapters are based on different deliberations by the participants from selected secondary schools. Again included are what emerged in the study as the elements that contributed to the achievement of the purpose of this study.

As can be noticed, all the above characteristics of the qualitative research approach are significant in this study. Following the above characteristics are the types of qualitative research design. I have included these research designs to explore their potential challenges and be able to make an informed decision for this study.

4.3.1.1 Narrative design

The narrative research design puts emphasis on storytelling (Creswell, 2007:53).The data is in the form of participants' lived experiences. The procedure involves one or

two participants who share their experiences about a particular event in a chronological order (Creswell, 2007:57).

4.3.1.2 Phenomenological design

Whereas a narrative study deals with lived experiences of one or two participants, a phenomenological study describes the meaning for several participants' lived experiences of a concept (Creswell, 2007:58).The focus is on describing a common experience of a phenomenon by the participants. The researcher collects data from participants and thereafter develops a composite description of the essence of the experience for all individuals (Creswell, 2007:58).

4.3.1.3 Grounded theory design

While phenomenology and narrative designs put emphasis on the lived experiences of participants, the focus on a grounded theory design is to generate or discover a theory (Creswell, 2007:62). The participants have experienced the event and the development of a theory might assist to explain the practice for further research (Creswell, 2007:62-63).

4.3.1.4 Ethnographic design

An ethnographer is interested in examining the shared patterns of the participants and the unit of analysis is larger than 20 (Creswell, 2007:68). The focus is on the entire cultural group (Creswell, 2007:68).

4.3.1.5 A case study design

A case study is an in-depth analysis of a single entity a researcher intends to investigate (McMillan & Schumacher, 2010:344). According to Punch (2009:119) and Royse (2008:53), a case is a strategy that allows for a problem or issue to be studied in depth within a bounded context. The case study design was appropriate for this study because I intended to get a deeper understanding of a problem at hand, which was secondary-school teachers' ICT competency in classroom practices. I neither wanted the participants to narrate their lived experiences in a chronological order as

in the case of narrative design nor to develop a composite description of the participants' live experiences as in the case of the phenomenological design. Grounded theory design was also inappropriate because my intention was not to generate a theory for my study. My intention again in this study was not to become an ethnographer because I was not examining a particular phenomenon as a shared pattern among the participants. The following discussion elaborates on my choice of a case study design.

Royse (2008:272) puts forward the following steps that have to be pursued in a case study:

- Selecting the case one must decide whether the unit of analysis will be individual, a social service programme and school organisation. The secondary schools as natural settings in this study represented cases. Secondary-school teachers who were knowledgeable about ICT usage were the units of analysis that led to the knowledge and understanding of secondary-school teachers' ICT competencies in classroom practices.
- Determining the issues and questions to be focused upon. From the outset I had the desire to investigate teachers' ICT competencies in classroom practices. Hence, the questions that were asked to keep track of teachers' ICT competencies were: How do secondary-school teachers integrate ICT in their classroom practices? What are the challenges experienced by secondary-school teachers when integrating ICT in classroom practices? What support do secondary-school teachers receive to effectively integrate ICT in classroom practices?
- Selecting the sources of data to draw upon, for example interviews with neighbours, available documents and records, visits with and direct observation and records. The secondary-school teachers who were knowledgeable about the use of ICTs in teaching were the sources of information. The use of three data collection strategies mentioned in the characteristics of the qualitative research approach in 4.3.1 above assisted in the gathering of information about secondary-school teachers' ICT competencies.

- Collecting data, that is, gaining entry to and the trust of those capable of providing useful information about the case is always a major consideration and sometimes a challenge for qualitative investigators. The data was collected from the participants (teachers) and I had to respect their well-being and protect their reputation through research. For this reason as a researcher I requested permission from the concerned gate-keepers to interact with the participants.
- The interpreting and analysing of the collected data. The gathered data was analysed and interpreted in word tables, photos and figures for better understanding.

There are three types of case studies, namely: intrinsic, instrumental and collective or multiple case studies (McMillan & Schumacher, 2010:345; Helen, 2008:2; Creswell, 2007:74). The intrinsic case study involves the investigation of one unique case (McMillan & Schumacher, 2010:345; Punch, 2009:119). In other words, the focus is on deriving a better understanding of a unique case itself. In a unique case, a researcher should focus on its exceptionality in a real-life situation.

The instrumental case study is different from a collective type of case study. These types of case studies differ because in using the instrumental case, the researcher starts by selecting a case, then builds up an argument around it. In collective case studies a researcher is prompted to investigate a phenomenon and the cases are used to find answers to that problem. Hence, the choice of the collective or multiple case studies best suited this study because as the researcher I was curious to gather detailed information about different secondary-school teachers' ICT competencies in classroom practices.

Collective or multiple case studies are used when the researcher investigates a phenomenon and chooses multiple cases to illustrate the phenomenon (McMillan & Schumacher, 2010:345; Punch, 2009:119). This implies that a researcher can choose to investigate the same phenomenon in different cases. In this study I chose the collective or multiple type of a case study over the intrinsic and instrumental because the intention was to explore perspectives of secondary-school teachers' ICT

competencies from a few different locations. The use of cases in this study assisted me to dig deeper into the data in order to get rich descriptions of the phenomenon under study. The following phases of data collection elaborate on how secondary-school teachers' ICT competencies were investigated.

4.3.2 Phases of data collection procedures

Data collection procedures in this study (which includes ethical procedures) were executed by adapting McMillan and Schumacher's (2010:329) five phases. A brief discussion of each phase is set out below.

4.3.2.1 Phase1: The permission to access the research sites

As far as this study was concerned, I requested entry into four secondary schools within Bojanala District through the following gatekeepers: the UNISA College of Education's Research Ethics Committee, the Bojanala District Director, and the schools' site managers. I applied for an ethics clearance certificate (refer to appendix 1) through completing an ethics form. I wrote two letters to request permission to gain entry to schools, one to the Bojanala District Director (refer to appendix 2) and the other one for the selected secondary schools' site managers (refer to appendices 3A - 3D). Appendix 8 evidences the response from the Bojanala District Director. The issue of requesting entry to the selected secondary schools necessitates ethical consideration. A brief discussion about this aspect follows below.

- **Ethical considerations**

This code of ethics is prepared with the aim of devising the role that elicits cooperation, openness and fosters good relationships between the participants and the researcher (McMillan & Schumacher, 2010:338). Furthermore, it compels the researcher to be honest and trustworthy when interacting with the participants at a site. In simpler terms, the researcher should never take advantage of collecting data from participants at their own expense as individuals and not being considerate about their welfare and safety. In essence, the researcher is expected to avoid harming participants during the process of fieldwork by taking cognisance of their needs and interests and to respect them as well.

The researcher should devise the roles that elicit cooperation, mutual trust, openness, and acceptance from the participants (De Vos, Strydom, Fouche & Delport., 2012:113; McMillan & Schumacher, 2010:338). The relationship should encourage participants to be honest in divulging information. The guidelines pertaining to ethical considerations including these roles are articulated below.

- **Voluntary participation**

In order to ensure that participants participate freely and voluntarily in the study, they are made to understand their preferences in a research project and informed about the objectives and data collection strategies (Flick, 2009:37; Royse, 2008:62). If this information is not related to from the outset, the research outcomes might be misrepresented. During research it is imperative that the contribution to the study by the participants should not be imposed on them. The researcher is expected to take participants on board about information regarding the entire fieldwork, thus enabling them to make informed decisions. It is unethical to force them to participate in the study because they will not feel free to share information. The participants also have to be made aware that they are free to withdraw their participation at any time should they so wish during the course of the research.

In the context of this study, I made it clear to the participants that they were not forced to be involved in the study. I also ensured that they fully comprehended their role in the study and that their choice was respected. The clarification of participants' role in the entire study necessitated the completion of the informed consent form, which is discussed below.

- **Informed consent**

The informed consent is based on the information provided by researcher to agree with participants to be part of the study (Flick, 2009:37). The researcher is expected to adequately explain to the participants their role throughout the entire research study. This explanation, according to De Vos et al. (2012:117), should include the purpose of the study, possible advantages and disadvantages of the study, the duration of their involvement in the study and the procedures that have to be

followed. De Vos et al. (2012:118), in the same token emphasise that this process would relieve any possible tension and insecurity in the participants.

With regard to this study, I clearly communicated the following to the participants:

- Reasons why the research study was conducted, which was to investigate teachers' ICT competencies in order to suggest a strategy that could be implemented to assist them to effectively integrate ICTs in teaching and learning;
- The procedure or plan that was preferred to achieve the purpose of this study and to answer the research questions. I used the case study design.
- How data had to be collected, which embraced the data collection strategies mentioned in the previous paragraphs under qualitative research approach in section 4.3.1 above.

The above communicative information placed the participants in a better position of understanding what to expect in the whole data gathering process. At the end of the discussion I requested the participants to complete the informed consent forms (refer to appendix 4). The completion and signing of informed consent forms indicated that the participants understood their role in the research and were keen to participate in the study.

❖ **Anonymity**

For safety and trustworthiness' sake participants' names and shared information play a major role in a study, but have to be kept anonymous. Anonymity implies that no one including the researcher should be able to identify participants' responses (Anderson, 2009:74; Royse, 2008:65). In other words, the reader or the researcher is not expected in any way to be able to link participants with their contributions. The collected data was expected to be the participants' privacy. It is the responsibility of a researcher to protect participants from the general reading public (McMillan & Schumacher, 2010:339) by not disclosing their identities.

In order to maintain anonymity in this study, the participants' responses were concealed and not revealed to anyone. Codes were used to avoid attaching names to the information divulged. Instead of using participants' names, I identified them as teacher A, B, C up to H. The names of schools were also protected by using school A, B, C and D.

- **Confidentiality**

According to De Vos et al. (2012:119), McMillan and Schumacher (2010:122) and Anderson (2009:75), confidentiality denotes that no person would be allowed to access participants' data or names except that they have been informed about this from the beginning. In the context of this study, from the outset, I placed the participants at ease by informing them how their identity would be protected. I could not breach the confidentiality aspect of the agreement. As mentioned earlier regarding anonymity, I guaranteed the protection of the participants' identity through the use of alphabetical letters instead of their names. The research audience is expected to have difficulty in identifying the participants of the study as I kept their names secret and did not publish them. The following discussion details how the participants were selected.

4.3.2.2 Phase 2: Population and sampling of the study

Secondary-school teachers were an appropriate choice of a target population that could assist to achieve the purpose of this study, and also to answer the research questions, as such they had to be carefully sampled.

Sampling is a choice of a smaller number of people drawn from a large population from which data is collected (Anderson, 2009:201; Punch, 2009:359). Flick (2009:121) and Yin (2011:88) maintain that sampling is done in accordance with relevance to the phenomenon under investigation. This study embraced purposive sampling which, according to Creswell (2007:118), is used to best enlighten the researcher concerning the problem under investigation. Equally important, the researcher specifically preferred purposive sampling because the participants were expected to have one common characteristic which was the knowledge about the

phenomenon (Royse, 2008:212). Eight secondary-school teachers who integrated ICTs in teaching and learning were sampled within Bojanala District. The selection was based on their expertise in the use of ICTs. I requested two teachers from four site managers who integrated ICTs in teaching and learning.

These teachers were expected to provide significant information about the use of ICTs in classroom practices. As participants, they were expected to be good informants in articulating their lived experiences and the challenges they faced in the use of ICTs. In this study, the participants shed light on the use of ICT in classroom practices. Creswell (2007:128) supports this notion by maintaining that the criterion sampling works well when participants are willing to share information and have experienced the phenomenon under study.

During the first visit to selected secondary schools, I requested teachers who were knowledgeable about the use of ICTs in teaching and learning to participate in the study. The discussion below proceeds to the journey of finding out the truth about secondary-school teachers' ICT competencies in the natural context.

4.3.2.3 Phase 3: Data collection and strategies

This is an important phase in a research process because without collecting data nothing would be analysed or even reported. Data collection strategy refers to the gathering of data which is relevant to the research problem through strategies such as interviews, observation, document analysis, audiovisual aids and focus groups (Royse, 2008:37; Creswell, 2007:75). Creswell (2007:75) further asserts that data collection is the provision of a detailed description of the daily delivery of the activities of the case. The collected data in this study was generated in the structure of words and language through three data collection strategies. The qualitative data does not rely on measurements as in the case of a quantitative research approach as it is less structured and questions posed are usually objective.

For the purpose of this study, the data collection strategies were semi-structured interviews, non-participation observation and document analysis. According to Flick (2009:444), the use of different data collection strategies promotes quality in

qualitative research. In this study quality promotion was done through the use of the above-mentioned three data collection strategies. The following section details each data collection strategy.

- **Semi-structured interviews**

Royse (2008:273) asserts that an interview is the most important data collection strategy in qualitative research and is used to fully explore the study phenomenon in-depth. The use of semi-structured interviews in this study was aimed at exploring participants' views about the use of ICTs in teaching and learning. The instrument that was used to gather semi-structured interview data was the guiding open-ended questions (refer to appendix 5). These guiding questions were objective and as such enabled me to be flexible and gather in-depth helpful data.

In an interview session, probing should be done to encourage participants to further give detailed information about their experiences, feelings and motives about the phenomenon under study (Anderson, 2009:188). My role as the researcher was to initiate communication and encourage participants to keep on talking. During the semi-structured interviews I kept on probing to let participants feel free and thus enabled them to further build on their thoughts. For example, I requested more information through requesting them to elaborate on issues. Appendix 14 exemplifies the recorded semi-structured interview response of teacher B from school A.

Briggs and Coleman (2007:209) affirm the participants' free will of sharing information. They mention that interviewees should be given opportunity to respond as they best see fit. I made sure to give the participants ample time to voice their ICT usage experiences and challenges that they faced in classroom practices.

In this study I interviewed eight selected secondary-school teachers at their respective schools, in an environment free from disturbances. The interview environments were well prepared in advance with the aim of putting participants at ease to answer the research questions freely. At two of the selected secondary schools the venue was a computer laboratory; at the other two selected secondary schools, the School Management Team members' (SMTs) offices in the

administration block were used. The semi-structured interviews were conducted for a little less than one hour each and it all depended on each session's deliberations. This process took the form of individual face-to-face interactive communication between the participants and me.

It was not an easy task for me to note all the important deliberations, hence to avoid losing important data, I recorded all semi-structured interview sessions through a Samsung Galaxy Note II cell phone. Before each interview session started, I explained the reason why recording had to take place and at the same time requested permission to record the discussions.

- **Non-participant observation**

Royse (2008:276) declares that qualitative researchers also involve observation data collection strategies to fully capture visual details as well as auditory and sensory aspects of a classroom. McMillan and Schumacher (2010:350) share the same sentiment, mentioning that observation is a method that the researcher uses to see and hear what is occurring naturally in the research place. Non-participant observation was selected in this study with the intent to watch, listen and find information about secondary-school teachers' ICT competencies. As the researcher I observed selected secondary-school teachers' ICT competencies through participants' actions and behaviors during their presentation of the technology-integrated lessons. I used a guiding observation checklist (refer to appendix 6) which listed what had to be observed.

Anderson (2009:181) claims that the advantage of employing this strategy is its directness and that the researcher as an observer is able to see the behaviour and actions at first hand in a real-life situation. The same eight secondary-school teachers who participated as interviewees were observed with the intention that they showcase their ICT expertise in presenting technology-integrated lessons. I requested permission from the participants to video-record all the presentations to facilitate transcription of the observation sessions and also to give me a chance to replay them if need be to get a clearer picture of the observation sessions. In every observation session I also took field notes on a mini-smart iPad tablet. The evidence

of field notes did not only entail what happened during the observation sessions but also included reflections pertaining to what occurred at a site.

- **Document analysis**

For Flick (2009:259), documents represent a particular report of realities created for a specific purpose. Flick further emphasises that documents should be used as a way of contextualising information and not as information containers. What Flick puts forward is that documents do not highlight information constructed for a specific event but reflect how the events about something unfold in a particular setting. Anderson (2009:163) in support stresses that documentary evidence enhances other data collection strategies' evidence, and justifies the setting's context as well. Document analysis in this study complemented the semi-structured interviews and non-participant observation. This strategy augmented the other two strategies because together they provide a more comprehensive data.

De Vos et al. (2012:377) and Creswell (2007:130) identify different types of documents such as journals, diaries, personal letters, public documents, autobiographies and biographies, photos, chart audits, medical records, personal documents such as minutes of meetings, agendas, newsletters and internal office memos.

Regarding this study, I analysed the minutes of the staff meetings, records of strategy of implementation of ICTs in classroom practices and teachers' technology-integrated lesson plans. I requested these documents from the four site managers of the selected secondary schools. The aforementioned documents played a vital role in this study because they contextualised what transpired daily at the schools as far as the use of ICTs in teaching and learning was concerned. Also, they revealed teachers' experiences and challenges in a real-life situation as regards the use of ICTs. The guiding document analysis instrument assisted me to gather data (refer to appendix 7). This entire process of data collection took a considerable length of time to get all data captured, transcribed and analysed. The end of the data collection session section is discussed below.

4.3.2.4 Phase 4: The end of data collection session

This phase was the conclusion of the data collection process (McMillan & Schumacher, 2010:329). I maintained the status quo by vacating the selected secondary-school settings and started with the initial stage of data analysis. I completed fieldwork and began to analyse the collected data. McMillan and Schumacher (2010:330) emphasise that data analysis and diagrams are essential for interpretations. I used word tables, figures and photos for better understanding and interpretation of the outcomes. The discussions on data analysis below conclude the journey to achieve the purpose of the study and to answer the research questions.

4.3.2.5 Phase 5: The beginning of data analysis

The gathered data in a research project should be analysed or else its collection would be worthless. Qualitative data analysis entails establishing categories and assigning codes in the collected data with the aim of developing themes or patterns that can describe the phenomenon under study (Anderson, 2009:214; Royse, 2008:276). De Vos et al. (2012:252), in support of the development of the themes, argues that data analysis is preparing the collected raw data for examination. However, Baxter and Jack (2008:554) have a different perspective; that is, they assert that data analysis occurs simultaneously with the data collection process as the researcher interacts with participants and data collection strategies.

The discussions in the above paragraph mean that the entire process of data analysis involves the constant revisiting of data collection strategies, to find similarities and differences pertaining to the phenomenon under investigation. Royse (2008:276) declares that the identification of similarities and differences relies entirely upon the researcher's understanding of the collected data and how to make sense of it. The researcher is expected to read the collected data several times in order to ensure that all themes are catered for. For the purpose of this study, I read the collected data repeatedly and developed themes through coding concerning teachers ICT competencies in classroom practices.

The following table represents the procedure that should be practised when analysing data and also includes the procedure I followed in this study (Creswell, 2007:156,157).

Table 4.1 Procedure to analyse data (Adapted from Creswell, 2007:156,157).

Data analysis and representation	**Case study**	**Procedure in this study**
1.Data managing	Create and organise files for data.	I compiled and reduced the semi-structured interviews, non-participant observation and analysis of documents field notes to manageable and understandable information.
2.Reading memoir	Read through text and make marginal notes from initial codes.	In this step I read through the collected data to make sense of it by making notes from initial codes.
3. Describing	Describe the case and its context.	In order to contextualise secondary-school teachers' ICT competencies I detailed information about the cases in this study. This information gave background information about ICT usage in the selected secondary schools.
4. Classifying	Use categorical aggregation to establish themes or patterns.	In the process of coding, I noted the relationships in the collected data. The process also involved the checking and rechecking of accuracy in the collected data. In essence this was the establishment of themes through coding. Similar phrases were assigned the same codes.
5. Interpreting	Use direct	I did direct interpretation of information which

	interpretations.	was portrayed through word tables, figures and photos.
6. Representing and visualising	Present in-depth picture of the case (or cases) using narrative tables and figures.	The interpretation of information was represented in the word tables, figures and photos which gave a clear picture of what transpired in the field.

Anderson's view links with the given illustration above. Certainly, the most significant role that the researcher should play is to understand the field notes and categorise themes correctly in accordance with the phenomenon under scrutiny. The above table also gives a brief clarification of how the data was analysed. More in-depth discussion about how data was analysed is considered in Chapter Five where coded data is interpreted and presented in word tables, figures and photos in order to display a more detailed and understandable version. Measures used to ensure trustworthiness are discussed below.

4.4 MEASURES TO ENSURE TRUSTWORTHINESS

In order to ensure trustworthiness, the researcher persuades the readers that the outcomes of the study are noteworthy (Babbie & Mouton, 2012:276). Babbie and Mouton (2012:276) further stress that good qualitative research has the principle of trustworthiness which aims to support the research findings.

The following table presents the elements of trustworthiness in qualitative and quantitative research.

Table 4.2 Qualitative and quantitative notions of trustworthiness (Adapted from Babbie & Mouton, 2012:277)

Quantitative	Qualitative
Internal validity	Credibility
Eternal validity	Transferability
Reliability	Dependability
Objectivity	Confirmability

As this study pursued a qualitative research approach, the operational measures relating to qualitative research are discussed below.

4.4.1 Credibility

Credibility is actions taken by a researcher during fieldwork. According to Babbie and Mouton (2012:276) and Creswell (2007:207), credibility is addressed through the following procedures:

Prolonged engagement: This implies spending adequate time with the participants in order to get to know them, to build trust and rapport and concurrently gathering data until it reaches saturation.

In empirical research, a researcher is expected to be engaged in fieldwork until data saturation occurs (Babbie & Mouton, 2012:277). Royse (2008:280), on the one hand argues, that a researcher in fieldwork does not only invest sufficient time in learning about the phenomenon under scrutiny but also tests his or her understanding of it. In addition, McMillan and Schumacher (2010:330) on the other hand emphasise that the extended fieldwork allows interim data analysis and the verification of findings and what happened in a real-life situation. Creswell (2007:207) argues prolonged

engagement from a different perspective; he asserts that the decision about what is essential for a particular research project rests upon the researcher's shoulders. The lengthy data collection period provides opportunities for interim data analyses, preliminary comparisons, and corroboration to refine ideas and to ensure the match between evidence-based categories and participants' reality (McMillan & Schumacher, 2010:331). All these view expressed by different authors have one common thread, namely that prolonged engagement deepens the researcher's understanding of the phenomenon under study and the researcher becomes oriented to the site and to better understand it as well.

As described earlier in this chapter, I conducted fieldwork in phases and these phases necessitated extended engagement with the participants. The first engagement took place when I delivered two letters requesting permission to use the schools (refer to section 4.3.2.1). The second engagement occurred when I started to establish trust and rapport with the participants and at the same time attended to ethical issues (refer to sections 4.3.2.1).

The sampling process also contributed to the prolonged engagement when I met the participants during the first visit to schools (refer to section 4.3.2.2). The face-to-face interaction started with semi-structured interviews, non-participant observation and document analysis. Not all of these sessions went according to the plan. In most instances, there was a rescheduling of one of the three data-collection strategies. For instance, in school A I agreed with the participants to meet on a particular day and there was an event that they were supposed to be engaged in. Hence our appointment was rescheduled. In school C there was also a break of communication and I arrived at the school a period before the lunch and waited for a chance after lunch. But ultimately I could not meet the participant and went back home. Another incident happened in school D, where there was a break of communication. When I arrived at the school, the participant was expected to take learners on a sports trip and did not get chance to inform me. I had no choice but to reschedule our appointment. At the same school the other participant was not aware that I was waiting for our semi-structured interview session. I happened to see the participant during lunchtime and there was no period left to do the session.

The rescheduling of time assisted me to get more acquainted with the phenomenon. The more I got disappointed or rejected to proceed with the session, the more chances there were of refining ideas and better understanding the problem, because I interacted more with and simultaneously analysed the gathered data. All in all, the prolonged engagement increased the spirit of working together and enabled me to convey a detailed report about the cases and participants.

Persistent observation: These continual observations, according to Babbie and Mouton (2012:277), without any fail provide a different viewpoint. For Royse (2008:280), observation should be done daily and recording of what transpired is essential as long as the researcher focuses on answering the research questions and remembers the purpose of the study.

In this study I took note of all occurrences on site. After each data collection strategy session, I had thirty minutes to one hour's reflection on what happened during that session. These reflections were done after each session while the information and incident were still fresh in my mind. This is evidenced by reflections that are provided in Chapter Six of this study. The information was essential to the study as some of the relevant data emerged from the observations during these visits.

Triangulation involves a means used by a researcher to gather data through a variety of data collection sources in order to shed light on a problem under investigation (Flick, 2009:445; Anderson, 2009:139). Rothbauer (2008:2) adds that each type of data collection source would yield different evidence that would provide different insights regarding the phenomenon. This approach is also employed to increase credible, accurate and valid research results (Anderson, 2009:45; Hussein, 2009:3).

In terms of this study, I employed data triangulation as three data collection strategies were pursued. The aim was to get different perspectives concerning secondary-school teachers' ICT competencies in classroom practices and to strengthen my findings and support the data analysis as well. According to Royse (2008:156), the convergence of these data collection strategies should dovetail in a comprehensive, logical, coherent picture of what transpires in a real-life situation.

Each data collection strategy in this study yielded a different perspective that provided different understanding of secondary-school teachers' ICT competencies. Certainly, the data triangulation process offers greater confidence in terms of receiving different dimensions and thus enriching the researcher's interpretations and data collection corroboration. Again, the use of three data collection strategies in this study ensured a robust and well-developed sharing of information.

Referential adequacy entails the use of material employed for documentation (Babbie & Mouton, 2012:277). I used the video recorder in this study to capture non-participant observation sessions, a Samsung galaxy Note II cell phone to record semi-structured interview data and an Ipad tablet to write my fieldwork reflections. All these technological devises assisted me to capture a wealth of information. These recordings ensured that important information was not missed.

Peer briefing involves requesting someone who is outside the study to review the researcher's study (Babbie & Mouton, 2012:277). Babbie and Mouton (2012:277) further assert that such a person should have similar status as the researcher and be knowledgeable about the phenomenon under investigation. As this study was progressing, I presented my progress at several conferences to allow peer examination for example at the Teacher @ distance conference held at KwaMaritane North West province SA on the 8th to 11th April 2014.

. The comments raised at these presentations assisted to improve and increase the truth-value in this study. I also requested a colleague who was furthering her studies within the field of ICT to review the whole research study. My colleague thoroughly examined my study and made comments and amendments which were incorporated to the study. The reviewing of the study provided support and also contributed to trustworthiness of this study.

Negative discrepant data: Negative discrepant data normally surfaces as a researcher eliminates outliers or exceptions that do not fit the pattern or themes found in the gathered data (McMillan & Schumacher, 2010:331; Creswell, 2007:208). In terms of this study, I decided on what to include or discard that could contribute to the answering of the research questions. This was done through scanning the

gathered data and a few items which were found not to match the formulated themes were thus discarded.

Member check involves going back to the sources of information to make sure that the collected data represents a true reflection of the fieldwork. Creswell (2007:208) emphasises that the participants should be given a chance to evaluate accuracy and credibility in the collected data. In essence the participants are expected to correct errors and provide more inputs, if need be. For this study, I visited the participants after the transcription of data and requested them to informally check their contributions; few amendments were made and additional information provided. After the analysis of data, I went back to the participants to make a final judgement of their contributions before the final version was produced. Interestingly, one of the participants was very excited to notice that their names were not indicated but instead letters of the alphabet were used as their names.

4.4.2 Transferability

For Babbie and Mouton (2012:277) declare that transferability implies the extent to which the findings can be employed in other settings and engaging different participants. Although transferability is dependent on the interpretations and understanding of the research study's audience, Babbie and Mouton (2012:277) further maintain that qualitative researchers are not primarily interested in generalising the results. In other words, the knowledge gained from one context cannot be used by the same researcher in another context or the same context but using different sources of information. Hence, in this study I cannot claim that transferability could be maintained as this study was qualitative in nature. The onus rests on readers' understanding of the knowledge constructed in this study to transfer the findings. However, I have appended at the end of this study the instruments that assisted me to generate answers to the research questions. These instruments can enable the readers or researchers to transfer the findings of this study to other cases or to repeat the procedures of this study to the same cases but using different participants.

4.4.3 Dependability

According to Babbie and Mouton (2012:277), the techniques used to ensure credibility also establish the notion of dependability in a qualitative study. Hence, it is not necessary to treat dependability as a separate entity to credibility in the study as they perform the same function. In this study I addressed dependability while credibility was maintained (refer to section 4.4.1 above).

4.4.4 Confirmability

This is the degree to which the findings are the product of the focus of the inquiry and not of the biases of the researchers (Babbie & Mouton, 2012:278). In simpler terms, there must be evidence of all fieldwork occurrences and not the researcher's assumptions. The audit trail was done by my mentor who contributed to this study by checking all my chapters before I submitted them to the promoters. The auditing was done through examining the original transcripts, data analysis documents, fieldwork notes, comments from the member checking and the thesis text itself. The conclusion below completes this fieldwork journey.

4.5 CONCLUSION

This chapter has articulated the paradigm stance of this study and presented the research design, which included the qualitative research approach, the case study design, the target population that was sampled, data collection strategies and how the collected data was analysed. Ethical clearance was included as were measures that were used to gain participants' trust and to keep collected data as confidential as possible. Also included in the discussion were the measures to ensure trustworthiness. In short, I clearly highlighted the road that was followed to achieve the purpose of this study and to answer the research questions. The next chapter reveals the outcomes of fieldwork.

CHAPTER FIVE
THE PRESENTATION OF THE FINDINGS

5.1 INTRODUCTION

This chapter presents the findings of this study. I analysed data according to the four key steps suggested by Anderson (2009:213) mentioned in Chapter One (refer to section 1.11.6) and Creswell's procedure for analysing data (refer to table 4.1). I compiled and reduced the gathered data into manageable and understandable information and thereafter identified similarities and differences which led to the development of themes through coding (refer to appendix 10). Similar themes were grouped together and thereafter described, analysed and presented in word tables, figures and photos for a clearer interpretation and discussion of what transpired in the fieldwork.

The chapter has three sections. The first section embraces an overview of the fieldwork settings. I illustrate how the research context might have influenced or contributed to the findings. The secondary schools as cases in this study differed in the ways they approached or integrated ICTs into the curriculum. This background information also facilitated the understanding of the participants ICT usages in this study.

The second section entails the biographical information of the participants. This information demonstrates how the participants' views have been influenced by their lived experiences and challenges of ICT usage. The staged life of the participants would locate them in the understandable stance which was associated with their responses to the questions of this study. The last section deals with the analysis, the interpretation and the discussion of the findings.

5.2 SECTION ONE: THE RESEARCH SETTINGS

I was granted permission to access the research settings at four secondary schools within the Bojanala District in the North West (NW) Province of South Africa. To protect the privacy of these schools I identified them as schools A to D. I did not pay much attention to the location of these schools as my choice of settings was based on proximity to where I reside. However, it emerged in my fieldwork that the three schools (schools A, B, and C) I selected were located in rural areas and only one school was in an urban area (school D). The gap between rural and urban schools' ICT usage was an eye opener to me: two selected schools in rural areas were faced with ICT infrastructure vandalism and had to devise some means of integrating technology in teaching and learning. South African schools in rural areas are disadvantaged and not well resourced as compared to schools in urban areas. Hence, this gap should be taken into cognisance as an impeding factor for South African teachers and learners who are expected to join the realm of capable ICT users. A brief discussion of each case setting follows below.

5.2.1 School A

At the time of conducting this research this school was regarded as trapped because Grade Twelve learners did not achieve good results. A trapped school is a term that is used to refer to South African secondary schools that perform less than a 75% pass rate in Grade Twelve final examination results. The District Office identifies such schools and thereafter takes the responsibility of assisting them to improve the Grade Twelve learners' results.

School A's computer laboratory had been vandalised and all the computer cases were stolen. However, as this school was classified as trapped, the Department of Basic Education (DBE) came to their rescue by donating the e-learning unit machine (technological device) with the aim of enabling teachers to enhance teaching and learning. The photo below shows school A's e-learning unit machine.

Photo 5.1 School A's e-learning unit machine

The snapshot above shows an opened e-learning unit machine. The laptop is placed on the machine, a data projector appears behind the laptop (although not clearly visible), and the monitor is contained in a box behind the laptop. The computer case is housed inside the machine. The keyboard, router and a digital video disc (DVD) recorder also form part of this e-learning unit machine. The provisioning of this equipment demonstrated the efforts that the DBE had taken to motivate school A's teachers in integrating ICTs in teaching and learning. There were also DVDs that teachers could use to augment their classroom practices. In addition, the school was provided with educational software to enable teachers to enhance their classroom activities.

The e-learning unit machine was stationed in the computer laboratory that was no longer operational. When teachers used this technological tool, they had to move it from the computer laboratory to the school hall as it was the only suitable place to house it. This process of moving it was time consuming, and teachers had no choice as the e-learning unit machine was the only technological tool that they could use to enhance the process of teaching and learning. Nevertheless, the school hall was next to the computer laboratory and the e-learning unit machine could be wheeled

from one venue to the other. A point of concern was that teachers did not receive any training of how to operate this machine. They had to use trial and error until they got to know how to operate it.

5.2.2 School B

School B was a Dinaledi School. Dinaledi schools are the South African secondary schools that perform excellently in Mathematics and Physical Science. The district was mandated to support these schools so as to keep up the good work. School B offered Computer Application Technology (CAT) as one of its subject choices in the curriculum. During my first visit at this school, the site manager indicated that it was not possible for me to conduct research as there had been a burglary in the school and all the computers in the computer laboratory had been stolen. I immediately realised that the site manager had a different perspective concerning ICT integration in teaching and learning. However, I explained to him the different methods of ICT usage. After much deliberation on this matter he agreed to let two teachers participate in the study. The site manager's perspective about ICT integration in teaching and learning gave me a clear impression of site managers' endeavours in ICTs usage. The computer theft in school D had an effect on ICT integration because learners were denied the opportunity to do hands-on technology. Interestingly, the theft of computers at this school did not deter participants to engage technology in their classroom practices. They resorted to available technological tools to augment teaching and learning.

5.2.3 School C

School C was also a Dinaledi School. This school offered Computer Application Technology (CAT) as one of its subjects in the curriculum. The site manager was overwhelmed by the use of ICT in teaching and learning. He could contain himself but engaged in a conversation about the implementation of ICT in their school. In essence he was ICT savvy and integrated it when he taught learners Economics. His comment was:

“teachers are reluctant to use technology, they have technophobia, as Dinaledi school we were provided with two laptops and two interactive whiteboards, the school has technology integrated curriculum, there are teachers who teach CAT, we have 3 computer laboratories well equipped and with data projectors, one of the CAT teachers demonstrated to them how to use interactive white board but nobody attempted to use it.’’

This was not a planned interview, but had just emerged as a burning issue echoed by the site manager, who felt obliged to voice something that had been worrying him about the use of technology in teaching and learning. Having been made aware of the above concern, I tentatively drew a conclusion about teachers ICT competencies because the gathering of data was in progress and had not reached the analysis stage.

5.2.4 School D

At this school the site manager was absent and I was welcomed by the deputy site manager. This school was also a Dinaledi school and the CAT subject was included in their curriculum. There was a misunderstanding as the deputy site manager assumed that all teachers were expected to participate in the study. I clarified the matter and two teachers who were ICT users volunteered to be part of this study. The computer laboratories were well equipped with ICT infrastructures. The range of technologies in this school mirrored a good solution to ICT integration in classroom practices. The following photo shows one of School D’s computer laboratories.

Photo 5.2 School D's one of the computer laboratories

The above snapshot of a computer laboratory displays a richly resourced technology environment. In such an environment learners experience hands–on technology and become motivated to participate in their learning. The richly resourced technology environment in school D would enable teachers to change their instructional strategies from a behaviourist teaching approach (teacher centred) to a constructivist teaching approach (learner centred). In particular, teachers were enabled to facilitate a technology-integrated lesson which motivates learners to actively participate in their learning. On the one hand, within such an environment (richly resourced technology environment) teachers are expected to assist learners by scaffolding the teaching and learning process, and on the other hand learners are expected to assimilate information which would enable them (learners) to become problem solvers. The only challenge is that most 21st-century teachers do not get kindled by this type of environment. They are challenged by their ICT competencies which cause them to draw back and doubt themselves as ICT users. The discussion about the participants' biographical information follows below.

5.3 SECTION TWO: THE PARTICIPANTS' BIOGRAPHICAL INFORMATION

Appendix 10 summarises the key information of the eight participants such as the school they belong to, the subjects and the level of ICT competencies. A detailed participants' biographical information is set out below:

5.3.1 Teacher A

Teacher A was a middle-aged male who was responsible for teaching grade eight learners Accounting. Teacher A rendered his teaching services at school A, which was located in a rural area. In his teaching role teacher A did not have any ICT related qualification. The integration of ICTs in teaching and learning was out of his own interest. The school's administrative officer always assisted teacher A whenever he encountered ICT operational issues. There was also a programme initiated by the neighbouring mine which was used to train teacher A and other teachers on how to use computers in classroom activities. This experience contributed to his ICT user skill.

5.3.2 Teacher B

Teacher B rendered his teaching services at the same school as teacher A. His current job in his forties was to teach Grade Twelve learners Physical Science. He received Computer Application (CA) as a course during his studies for an Advanced Certificate in Education Physical Science (ACEPS). Teacher B was also involved in a Physical Science project which led to the further reinforcement of his technological skills. The project was organised by the University of Pretoria. The purpose of this project was to improve the pedagogical practices of Mathematics and Physical Science teachers within their Area Project Office (APO).

5.3.3 Teacher C

Teacher C was also a male teacher who offered Mathematics and Physical Science to Grade Ten learners. He was employed at school B and the school was also situated in a rural area. The young teacher in his middle thirties held the computer

courses which he acquired at a university. As a Grade Ten Mathematics teacher, his teaching role also involved participation in the More Maths programme. The More Maths was an ICT programme donated by the Nokia Company to selected secondary schools within their APO. The software was installed in cell phones and teacher C had to assist learners to navigate through the software and facilitated the whole process of teaching and learning. In addition, he was expected to take the role of guiding learners to access the site and overcome operational challenges. The More Maths program included the entire Grade Ten Mathematics syllabus.

5.3.4 Teacher D

This participant, a female in her thirties, was a Grade Ten Mathematics and Physical Science teacher who also volunteered to participate in this study. Teacher D taught at the same school as teacher C. Her teaching role encompassed engaging learners in a More Maths programme. For her, the integration ICTs in teaching and learning was a challenging task. Teacher D furthered her ICT skills at the University of South Africa where she gained a broad background of ICT expertise. A competent ICT user was organised for their school to capacitate her colleagues on matters associated with the use of computers. Following training, some of teacher D's colleagues did not attempt to implement the ICT skills of which they had gained knowledge. Her former colleague also assisted her to get a deeper understanding of ICT integration in teaching and learning. She was dedicated to the ICTs as it was a matter of her own interest.

5.3.5 Teacher E

Teacher E worked at school D in a rural area. This female teacher was also in her thirties and shared her lived ICT experiences and challenges in this study. Although I did not focus on gender equality in my study, it struck me when I analysed the data that more male teachers had participated in this study than female teachers. This showed that male teachers might be more fascinated by the ICT usage than female teachers. Teacher E offered Grade Eleven Life Orientation (LO). She also had an Honours Degree in Multimedia Integration Program (MIP) obtained in a higher education institution in South Africa. Upon her graduation teacher E was keen to

integrate ICTs in teaching practices. One of her colleagues, a senior teacher assisted, teacher E to get deeper knowledge of ICT usage. Teacher E believed that ICTs make lessons easier and meaningful to learners. Furthermore, according to teacher E the use of computers for learning is fun and exciting.

5.3.6 Teacher F

Teacher F was a male Grade Nine Mathematics teacher employed at same school as Teacher E (school C). Teacher F obtained a Bachelor of Technology in Information Technology (BTech-IT) degree from a university. Prior to teacher F's current teaching role, he was a lecturer in Zimbabwe and had decided to relocate to South Africa for greener pastures. In his late forties, a Zimbabwean former IT lecturer had no choice but to conform to teaching Grade Nine learners Mathematics. A senior teacher at teacher F's school assisted him to be more skilful in the use of ICTs.

5.3.7 Teacher G

This participant was in the early thirties and offered Mathematics to Grade Nine learners. Teacher G worked at school D, which was situated in an urban area. He held a Bachelor of Science in Information Technology (BSc. IT) and was also a Zimbabwean. Teacher G was passionate about ICT usage but as teacher G was not a CAT teacher, he was not allowed to use the school's computer laboratories. This issue might give rise to another ICT usage research study that could contribute to the body of knowledge. In fulfilling his passion concerning the use of ICTs, teacher G integrated ICT in the classroom.

5.3.8 Teacher H

The above participant was a Grade Ten CAT and Business Economics teacher. Teacher H studied for an Advanced Diploma in Information Technology (AD.IT). He was in his early thirties and taught at the same school as Teacher G. Interestingly, teacher H had access to computer laboratories as he was a CAT teacher. As a former CAT teacher, I know that only CAT teachers and their learners were allowed to use computer laboratory. This might sound unreasonable, but all learners in a

school cannot share the same workstations. A workstation is used the same way as a learner uses his or her exercise book. This means that each learner should have his or her exercise book to write on or a workstation to operate. Confidential Information has to be kept by workstations' owners. Hence the sharing of workstations could cause a lot of confusion as far as information storage is concerned. The section below details the analysis, interpretation and discussion of the findings of the study.

5.4 SECTION THREE: THE ANALYSIS, INTERPRETATION AND DISCUSSION OF THE FINDINGS OF THE STUDY

5.4.1 The findings from semi- structured interviews

The semi-structured interviews were conducted with eight participants as discussed in Chapter Four (refer to Chapter 4, section 4.3.2.3). The purpose was to explore participants' views concerning the use of ICTs in classroom practices. The semi-structured interviews revealed the following themes:

5.4.1.1 Theme 1: The participants' ICT experience in teaching and learning

The majority of participants in the study indicated limited experience in the use of ICTs in teaching and learning. I discovered that participants had less than five years' experience in technology related matters. To illustrate the notion of limited experience the following responses were noted:

Teacher C from school B: ''*Eh …….since 2010".*

Teacher H from school D: *"Around, I can say three years now".*

The mastering of the device functionalities is also a challenge facing teachers' experience of ICT integration in teaching and learning. Lack of experience with the listed ICTs (refer to appendix 14) affects the teachers' confidence and ability to download or upload various ICT tools. In essence, the integration of ICTs in classroom activities requires lengthy experience which includes more time for lesson preparation, manoeuvring of the ICT tools' functionalities and exploring the various

links. As teachers become better acquainted with ICTs, they gradually understand the different ICT tools and operational issues related to these tools. However, findings from the available literature reveal that teachers in South Africa have limited experience of ICTs usage (Esharenana, 2010:3).

In addition, the participants' qualifications also contributed to their lack of competency as ICT users. I have discovered in the participants' biographical information that the majority of their qualifications seemed to limit them to effectively integrate ICTs in teaching and learning. For example, teacher A from school A did not have formal ICT qualifications; he only acquired his ICT skills through a program that was initiated by the mine to assist teachers in gaining ICT skills. Teacher B from the same school obtained an ACE in Physical Science which included, according to him, some form of computer applications. The findings revealed that the majority of the participants had not acquired the relevant ICT training. The literature has also shown that most teachers do not have background training on how to facilitate a technology-integrated lesson (Tropacki, n.d.:1; Ashari et al., 2009:89). In addition, the 21st century has brought considerable information that obliges teachers to engage technological devices in their classroom activities. Teachers are viewed in the educational context as sources that can turn around the education system to suit the digital natives. However, the barrier is their ICT competencies (Baron, n.d:26; Angeli & Valanides, 2009:155).

5.4.1.2 Theme 2: The available ICT infrastructure in the schools

Regarding ICT infrastructure the study highlighted unequal availability of resources in the researched schools. However, participants indicated availability of computer laboratories and other related ICT equipment in their respective schools (refer to table 5.1) as detailed below.

Table 5.1 Availability of ICT infrastructures in the selected secondary schools

School A	School B	School C	School D
Computer laboratory	Computer laboratory	Three Computer laboratories	Two Computer laboratories
Computers	Computers	Computers	Computers
Laptops	Two laptops	Two laptops	Laptops
Three data projectors	Data projectors	Data projectors	Data projector
Printer	Printer	Three printers	Four printers
Internet	Internet	Internet	Internet

Teachers E and F from school C indicated that they had three computer laboratories, whereas teachers F and G from school D had two computer laboratories. The participants indicated the availability of computers, laptops, data projectors and printers in their schools. As shown in table 5.1 above, school C had access to three printers and school D to four. Teachers A and B from school A did not highlight the availability of printers, but during the interview sessions I found out that their schools (teachers A & B from school A and teachers C & D from school B) had printers (refer to table 5.1 above). The same thing applied to internet connectivity. Teachers E and F from school C did not mention internet connectivity, but their site manager indicated the availability of internet in their school (refer to 5.2.3 section school C). One of the schools (school A) received internet connectivity from the local mine. This idea is illustrated in the following comment raised by teacher B from school A:

"*The mine also assists us with the connectivity, they have given us a router and we bought a simcard but the data bundles, we had to buy those ourselves."*

Although the schools received internet connectivity, it was still a challenge to keep their internet running throughout because of internal financial constraints at these schools (schools A-D). The concept of financial constraints at schools was described by teacher H (from school D) as follows:

"Without proper financing you will not have proper equipment, and without proper equipment no learning will actually be facilitated."

The financial constraints in schools resulted in denying learners the opportunity to explore internet services, but teachers A and B from school A and teacher B from school D had realised the importance of allowing learners to search information through their cell phones. The following excerpt is noted:

"What I do I usually encourage my learners to google information while in class through their cell phones. I allow them to use their cell phones because it is the only tool that is readily accessible." (teacher A from school A).

In the research conducted by Butcher and Associates (2007:5) as well as an article from the *Pretoria News* (Serrao, 2012) they indicate that the South African schools had budgets constraints and could not afford to buy ICT infrastructure (internet connectivity inclusive). Moreover, Isaac's study (2007: 24) as well as Ford and Botha (2007:2) have found that the ICT infrastructure in South Africa has proven to be a major concern for the integration of ICTs in teaching and learning.

5.4.1.3 Theme 3: The implementation of ICTs in teaching and learning

Regarding the implementation of ICTs in teaching and learning, the findings revealed that in school A and school B the implementation had been outsourced and was not planned or initiated by the institutions. At school C, the implementation of ICTs in teaching and learning came into effect through curriculum extension as CAT was included as a new subject offered in the higher grades and in the lower grades

computer literacy was offered even though it was not included in the curriculum. At school D the participants stated that when they were employed, the implementation of ICTs was already off the ground. The following excerpt illustrates the view of teacher H from school D:

> *"Unfortunately, I do not know how they started, but in my class I used my knowledge of computers and taught learners the basic fundamentals of computing at primary or high school level. So they learned Computer Technology, I mean Computer Application Technology. So that it is as far as they have progressed with regards to the ICT context."*

In addition, teachers A and B from school A pointed out that implementation of ICTs training was organised for teachers to keep track with ICT usage. However, teachers did not practice the knowledge they have acquired at the ICT training workshop. If teachers do not put into practice the ICT skill they acquired, their ICT skills will soon be forgotten or outdated and they will have to once more revisit the orientation. In–service training assists in keeping teachers updated with the new technological developments. Still, technology is indeed dynamic and teachers are expected to be competent ICT users and also be on par with the ever-changing technology. Teacher D from school B had the following experience pertaining ICT implementation at their school:

> *"At my school, we did everything manually. Manual reports, et cetera but ever since 2008 when I came here, it was the first year they had started mentioning the use of computers to make reports. So a program was developed which they began to use for making reports. Now, I think the government has bought their own program to do reports. Ever since then, everything has been computerised even the marking sheets which educators submit at the office. Of course some teachers face difficulties, but most of them are at least trying to use the computer in one way or another. Some teachers present their lessons using the computers and projectors in the classrooms. One of these teachers Mr X, I have seen him on a number of occasions using the projector.*

They also play movies for the learners using the projectors and the computers, so it's not all bad."

The literature review in this study has shown that efforts have been made to enable teachers to use ICTs; nevertheless, the majority of teachers are still unable to integrate ICTs in their classroom practices (Baron, n d.: 26; Angeli & Valanides, 2009:155)

5.4.1.4 Theme 4: The installation of software in computers

With regard to the installation of software in computers, table 5.2 Illustrates participants' interview responses which are followed by the findings.

Table 5.2 Interview responses about software installation

TA :	*Done once in a while*
TB :	*The company service the school in terms of ICT*
TC :	*Done by Dinaledi people once or twice a year*
TD :	*Responsibility of a person using the computer*
TE :	*Once in a while*
TF :	*Install GeoGebra*
TG :	*Have someone who can come, they normally update the systems*
TH :	*How it is really needed*

Since the participants had varied levels of ICT experience (refer to the participants' biographical information section 5.2), their opinions shown in table 5.2 provide different views regarding the installation of software in the computers. The results showed that only one participant (teacher F from school C) installed educational software (GeoGebra). According to Desjardins et al. (n.d.:214), in some instances teachers could be forced to rely on educational software in order to achieve the lesson outcomes. As table 5.2 indicates, some of the participants think that the

installation of educational software is not their responsibility (teacher B from school A, teacher C & D from school B and teacher G from school D).

If teachers do not install and navigate educational software, it becomes a barrier for the transformation of a teaching and learning environment, as discussed by Ward and Benson (2010:484) as well as Koehler and Mishra (2006:1028). Nevertheless, teachers should be on guard for emerging educational software as operating systems and application programs are upgraded annually by retailers. As new versions are released teachers should have the operational skills and knowledge of the previous and existing versions, then get acquainted with new versions. Otherwise teachers might not keep up with the pace of the latest technological developments that surface regularly. In view of the installation of software programs, the following response is noted (teacher H from school D):

> *"Our software installations basically depend on how it is really needed. But then again, updates are installed on a weekly basis. Anti-virus and software updates on weekly basis."*

As new computers are purchased in a school setting, teachers are expected to take the lead with the installation of the operating systems and the application program software as well. These are the fundamental requirements for the school computers to be operational. Desjardins et al. (n.d.:214) proclaim that the installation of software is one of the ICT competencies, namely epistemological skills, which involves capitalising on the use of technology to solve a problem.

5.4.1.5 Theme 5: The use of ICTs and the purpose of application programs in teaching and learning

ICTs were mainly used by all teachers in the selected secondary schools; however, the teachers' use differed in terms of purpose. For example, on the one hand CAT teachers used computers for teaching CAT as a technology-integrated subject. On the other hand, other teachers used technology for administration purposes such as calculating learners' quarterly marks and the typing of tests and examination papers. Although the majority of teachers used ICT for administration purposes, I believe that

they are interested in enhancing their classroom practices through ICT usage. The following excerpts illustrate the use of ICT by the participants' colleagues:

> "*Sometimes, they only use it when they are expected to enter marks, not for teaching and learning"* (teacher E from school C*).*

Another participant said:

> "*Yes they do. Like I can give an example of my colleague who is teaching Accounting. I, we are normally together, mostly on the internet at the library, he said he is surfing the internet." (*teacher G from school D).

The participants' responses evidence teachers' interest in integrating ICTs in classroom practices. However, the barrier was their low level of ICT competencies. The different ICT competencies mentioned by Desjardins et al. (n.d.:214) and Baron (n.d.:25) play a significant role in the use of ICTs in teaching and learning. I was intrigued by the following participant's comment as it showed the available ICT infrastructure at one of the secondary schools (school A), but teachers were sceptical or rather afraid to join ICT users (teacher A from school A):

> *"Currently all educators ….we've got the laptops in our Heads of Departments' (HODs) offices, so you know in order to type anything we take the laptop from them. Heads of the departments do whatever they do but there are some teachers who are not interested in using computers. Then we were provided last year with an e-learning unit machine that can be linked to the Department of Education's lessons in computer, like they use to do with the Bophuthatswana television. These teachers teach Mathematics and learners watch them on the television so we link them up with the Department of Education but very few attempted this, the Mathematics, Physical Science, and Accounting teachers, but currently it is not in use. Geography teachers are the ones who played DVDs in their computers and used them for teaching and learning".*

The above comment showed the need to motivate teachers to integrate ICTs in teaching and learning, because even if the infrastructure was available, they seemed

not to be interested. In the study conducted by Esharenana (2010:3), the findings revealed that 75% of the South African teachers are not technologically savvy. In addition, Naicker (2010:675) and Blignaut et al. (2010:69) in their studies found out that the use of ICTs in South Africa remains a tedious and considerable challenge facing teachers for now and even in the future.

When asked about the benefits of ICTs to teaching and learning, participants unanimously agreed that ICTs have a great deal to offer. One of the participants (teacher H from school D) expressed the importance of the use of ICTs in teaching and learning as follows:

> *"Unfortunately we live in the information age and you cannot go anywhere without computers. You just cannot. Everyone needs to learn at least to a certain degree how to use a computer, especially teachers. They are being pressurised to go digital nowadays so hard copies do not really work as efficiently as they did back then. So you need to know how to email, you need to know how to type. Not just typing, but then again after you type something, you need to make it look professional."*

In support of the above findings, teacher F from school C described the importance of ICTs as follows:

> *"There's no way we can run away from the use of technology, so the only way to go is to use it in the teaching and learning environment, there are some disadvantages which we encountered in the early stages, but I'm sure as long as we continue using ICTs we will be able to overcome the disadvantages which are associated with the use of it."*

It is evident from the findings that participants are experiencing some challenges as they integrate ICTs in teaching and learning. From the findings I also discovered that teachers need effective ICT skills that would enable them to use technological tools to support their teaching approaches. Participants further explained that ICTs make subjects easier for learners to understand. The concept of learner understanding is

reflected in the following excerpts (teacher B from school A and teacher E from school C):

> *"Our learners, our kids understand better when they see things and when technology is used".* (Teacher B)

> *"Yes, ICT makes lessons easier for learners".* (Teacher E)

In essence, 21st-century teachers have no choice but to integrate ICTs in teaching and learning so as to better learners' performance. Mills and Roblyer (2006: 6) align themselves with the notion pertaining to the use of ICTs in classroom practices as beneficial and a necessity.

In terms of the purpose of application programs, it is evident from the study that participants use an array of application programs such as Microsoft Word /word processing, Microsoft PowerPoint/presentation graphics, Microsoft Excel/spread sheet, Microsoft Access/data base, Microsoft Outlook/ emails and search engines.

The findings indicated that the participants collectively highlighted that Microsoft Word is mainly used for administrative purposes such as typing text documents.

The following response exemplifies the participant's response (teacher A from school A):

> *"That one we use on a daily basis for question papers, memoranda, is number one mostly for administration purposes, and not for teaching and learning."*

While there are several functions embedded in this program, the participants at least were aware of its main function, which is to type a text document. In addition, teachers are expected to teach learners how to make a text document presentable and attractive to the eyes of a reader. This can be achieved through the use of different Microsoft Word functionalities inserted in the various toolbars (Menu, standard toolbar and formatting toolbar). This is a technical ICT competency that teachers are expected to possess in order to do away with writing documents using

pen and paper and to engage in a modern way of preparing a document through typing and the click of a mouse.

All the participants except one (teacher G from school D) were familiar with the Microsoft presentation graphics program (Microsoft PowerPoint) as they indicated that it is used by teachers to teach learners through slide show presentations. However, during my observation sessions at schools I realised that only three participants (teachers C & D from school B and teacher H from school D) demonstrated their ICT expertise through slide presentations by means of this program. The findings reflect a lack of this skill as the majority of the participants did not convey messages to learners through the use of a PowerPoint presentation program. Teacher B from school A shared the following experience:

> *"PowerPoint presentations, we use them quite often. We use them when we have an event at our school. We would collect pictures of educators, learners and whoever to project them onto a wall or white board. We use learners to generate the slides in an attempt to teach them."*

Notably, the PowerPoint application program contains different formats, images and colours that can be used to let learners experience a real-life situation. This draws learners' attention and learners no longer learn within the four classroom walls but venture into a real-life situation. Teacher C from school B indicated the interest of learners in a new teaching approach through the following excerpt:

> "*Like I notice when we are teaching Maths on the computer, ah, everyone loves that lesson, you know. So at the end of the day, they will understand better than the ordinary way of teaching".*

The teaching approach indicated in the above excerpt differs from the teacher-centred approach to teaching whereby learners were expected to memorise and reproduce written information on the chalkboard as it was being presented. The learner-centred approach is better than the teacher-centred approach in the sense that learners are actively involved in their learning. UNESCO (2010:6, table 3.2) explains a teacher's role in the learner-centred approach.

With regard to the Microsoft Excel application program, the findings indicated that the majority of the participants associated this program with the calculation of numbers. In essence, this program alleviates teachers' stress to do a lot of explanation, as many Mathematical formulae are embedded in this application program. The findings show weakness in the use of this program because most of the participants used it for calculating learners' marks but indeed it should be used for teaching Mathematics. The following response confirms the above-mentioned weakness (teacher A from school A):

> *"Excel yes. The class lists, the mark sheets, calculation of marks, we do it on Excel."*

The findings reveal that the Excel program remains a challenge to teachers. Basically, teachers are expected to engage this program for teaching learners how to calculate sums during a Mathematics lesson.

Regarding Microsoft Office Access / database the findings reflected that only two participants were familiar with this application program. These two participants (teacher B from school A and teacher C from school B) were aware that Microsoft Office Access was used for organising information about learners and for administrative purposes. Teacher C from school B commented in the following manner:

> *"Access, yes they just use it in the office".*

The above response confirms the use of the Microsoft Access application program as mainly for administration purposes. However, the use of the Microsoft Access application program is to organise information in an orderly manner that allows for easy accessibility and retrieval. This computerised filing program could assist teachers on how the recording and reporting can be made simpler, quicker and more accessible just through the click of a mouse.

Furthermore, the findings revealed that not all the participants used Microsoft Outlook (e-mails) for teaching and learning. Surprisingly, two of the participants (teacher A from school A and teacher G from school D) mentioned that the e-mails in

their schools were used as tools for communication between schools and their Area Project Office (APO). They received e-mails from the APO and were expected to respond timeously. The following response by teacher A from school A bears evidence:

> *"Yes we receive emails daily from the Area Office or send information to them, in terms of teaching and learning, no."*

Another response by teacher G from school D is noted:

> *"Very much, communication with the Area Office, not really for teaching and learning."*

Astonishingly, this tool is used for administration purposes in these selected secondary schools and not for enhancing teaching and learning. Teachers were able to communicate with their APO but they had no idea about the sharing of scholastic information with learners through this tool. Siemens (2004: 2) in connectivism theoretical frame work stresses the ability to share relevant information with counterparts through communication tools and e-mail is one of such tools. Hence, teachers are expected to demonstrate to learners how to benefit from this communication technological tool.

Concerning search engines, the findings indicated that all the participants were acquainted with the use of search engines. During my fieldwork I found that three participants (teachers A & B from school A and teacher D from school B) had asked their learners to Google the meanings of their subjects' concepts (Accounting, Physical Science and Life Sciences) in their cell phones' search engines. The following responses said it all (teacher B from school A):

> *"What I do I instead right now in class instead of taking them to laboratory, I will rather ask them to take out their cell phones and google , which is not the good thing because we discourage the use of cell phones in the classroom , because they use them for music''*

(Teacher D from school B)*: "Yes, I normally use it to allow learners to search information and ask them to find what the other sources have to say about it. I want them to come up with the web addresses because one should type in the web addresses. I always check the sites. Some of them find very interesting information. I encourage them to do a thorough literature review and ask them not to plagiarise."*

Search engines are just another service offered by the internet tool. The use of the internet by these learners in their classrooms showed the potentiality possessed by the 21st-century learners in the use of ICTs. They did not attend lessons or read a device manual regarding the use of search engines, but it was out of their own interest and curiosity to explore and increase their knowledge and skills about navigating through the search engines. Learners are more fascinated than their teachers by the use of ICTs and want to learn more about them. However, the ball is in the teacher's court: the teacher is expected to be well versed in this ICT competency so as to teach learners how to work with a broad reference of materials embedded in this one other service of the internet.

All in all, Desjardins et al. (n.d.:214) stress the above-mentioned application program skills as the basic knowledge of computers and how to incorporate them in teaching and learning. The findings showed the participants' knowledge of programs and some of their functionalities, but the challenge remains as to how they use all the above-mentioned programs in teaching and learning.

5.4.1.6 Theme 6: The social networking tools

Regarding social networking tools, the findings showed a limited use of such tools (refer to appendix 11). Only a few participants showed their involvement in using tools such as the More Math program and the Thutong portal. It is evident from the study that two participants (teachers C & teacher D from school B) used More Math program to operate the chat sites as it was one of the links embedded in this software. This notion is illustrated by the following excerpt:

> "*Yes time for More Maths program. Learners do Maths not in their books, they will just be writing, doing the questions. All the questions are from the cell phones, More Math program.''* (Teacher D from school B)

In addition to the More Math Program, the Thutong portal was the only technological tool that three participants (teacher B from school A, teacher D from school B and teacher E from school C) were knowledgeable about regarding its potentiality. Thutong portal is an educational tool which is meant to assist South African teachers to share educational issues with their counterparts. Butcher and Associates (2011:32) in their research indicate the use of this communication tool (Thutong portal). They report that the Thutong portal was meant to assist South African teachers with teaching and learning materials, render accessibility to education policies and also provide schools with tools. The question is, are South African teachers aware of its existence or not? The following verbatim comments are enlightening:

> "*We use it frequently like searching for question papers*" (teacher B from school A).

Another participant said:

> "*Download questions from item bank to get support material''* (teacher D from school B).

On the whole, the findings showed limited use of social networking tools. It is evident from the study that not all the participants are familiar with the social networking tools. This may result from the lack of knowledge about the benefit of such tools. It is believed that in the education system teachers and learners are expected to discuss and disseminate scholastic topics through the chat sites. Kop and Hill (2008:1) and Siemens (2004:2) emphasise the notion of sharing information through social networking communication tools.

The following session involved watching and observing the participants as they portrayed their ICT expertise through lesson presentations (**non-participant observation session).** I also linked the observation findings to the TPACK

conceptual framework as this framework specifically depicts how technology should be effectively integrated in teaching and learning. The participants' lesson plans were compared to the technology-integrated lesson plan included in Chapter Three (refer to table 3.8.2). I had to ensure the inclusion of the following items in the participants' technology-integrated lesson plans as they complement on another towards the achievement of the desired skill:

- learning outcomes;
- lesson outcomes;
- assessment standards;
- a scenario;
- teaching method; and
- teaching and learning activities.

5.4.2 The findings from the observation of participants' lesson presentations which integrated ICTs.

All the participants demonstrated their technological expertise through the use of different ICTs. I observed how lesson presentations unfolded and watched how technological tools were employed to enhance teaching and learning. The findings revealed the following:

5.4.2.1 The technology-integrated lesson preparation

With regards to technology-integrated lesson preparation, some of the participants used the lesson preparation structure of the Curriculum Assessment Policy Statement (CAPS) and others used the NCS lesson plan templates (refer to appendix 12). CAPS was implemented at the time of conducting this study and had nearly scuppered the achievement of the purpose of this study. I accepted the submission of the two structures (lesson preparations and lesson plans) because they had one thing in common, which was the development of content knowledge

and skills of learners. The introduction of the CAPS lesson preparation might be a daunting gap to teachers' ICT implementation as teachers would have to be skilled on how to select the appropriate ICTs for their lesson preparation.

However, the findings showed that the majority of the participants did not include the lesson outcomes, learning outcomes, assessment standards, teaching methods, the scenario and teaching and learning activities, which affected the effective unfolding of their lesson presentations. When planning a technology-integrated lesson, all these items play a significant role as they contribute to quality teaching. Mishra and Koehler (2006:1029) state that the combination of the above-mentioned items gives rise to a constructive manner of presenting a technology–integrated lesson. The findings showed weakness in the preparation of this kind of lesson; the majority of participants relied on readymade lesson templates provided by subject advisors. Appendix 12 exemplifies the NCS lesson template which was used by teacher C from school B. The name of school B was deleted to maintain anonymity in the study.

The lesson plan template contains two pages. The first page of the lesson template shows learning outcomes, assessment standards, the date on which the lesson presentation was done, the activity involved and also the duration of the lesson. Teacher C was expected to have selected the relevant learning outcome and assessment standard by making a tick in the appropriate column, but neither selected neither the learning outcome nor the assessment standard. Teacher C only included the presentation dates and activities included. Although the lesson outcomes do not appear on the lesson template, teachers are expected to formulate their own lesson outcomes.

The second page shows both teachers' and learners' activities. There were also materials that were supposed to have been used in a lesson presentation, but none of them were selected, which made it impossible to understand whether there was the need for the use of material or whether teacher C from School B omitted it. The types of assessment and teaching methods on this template give teachers a broad choice which depended on the theme of the lesson. There was a space provided for

homework activities. There were also learning and teaching support materials that teacher C from School C was expected to have selected but this teacher omitted this task. The expanded opportunities in the lesson plan allow teachers to give learners more work to do as enrichment. Teacher C from school C was also expected to indicate learners' special needs which could have been catered for. This was not done or rather not taken into consideration. The scenario was not included in the lesson plan.

The lesson template showed the endeavour that subject advisors had gone to in order to alleviate teachers' stress in preparing a technology-integrated lesson. However, the ready-made lesson plan template hinders teachers' skills of preparing their own technology-integrated lessons. Teachers are expected to make an extra effort to prepare meaningful technology-integrated lessons. As such, a ready-made technology-integrated lesson plan would deny teachers the development of the unique knowledge they need to successfully integrate ICTs in their teaching and learning. Ward and Benson (2010:484) say that this unique knowledge would assist teachers to effectively integrate ICTs in teaching and learning.

5.4.2.2 The participants' technological knowledge

Technological knowledge has been discussed in two sections in this study. In Chapter Two, technological knowledge was considered as one of the components of the technological, pedagogical and content knowledge (TPACK) that form the unique knowledge needed by teachers to effectively integrate ICTs in teaching and learning. In Chapter Three, technological knowledge was viewed as one of the ICT competencies (technical competency) that enable teachers to face ICT technical challenges.

The findings revealed that all the participants demonstrated their technological knowledge by selecting the appropriate ICT tools for their lessons. This in-depth technological knowledge about different ICT tools is emphasised by Koehler and Mishra (2009:4) and Koehler et al. (2007:743). They describe it as a deeper knowledge that teachers should posses about different ICT tools which can enable them to enhance teaching and learning. Although all the participants selected the

appropriate ICT tools for their lessons, enhancing teaching and learning through such tools remains a challenge for some of the participants. Photos 5.4 (teacher A from school A's lesson presentation), photo 5.5 (teacher C from school B's lesson presentation and photos 5 and 6 (teacher E from school C's lesson presentation) exemplify the appropriate choice of ICT tools for lessons.

In terms of technical expertise, the findings showed that the majority of the participants were unable to effectively enhance teaching and learning through the use of ICTs. The teachers' inability to solve ICT-related technical challenges showed a lack of ICT technical competence. The findings indicated limited knowledge of the participants on how to improve teaching and learning through technological devices. Desjardins et al. (n.d.:214) describe technical competency as the basic operation of different technological devices.

5.4.2.3 The participants' technological pedagogical knowledge

According to the findings in all the lesson presentations the participants did not indicate the methods that they employed in their lesson presentations. The participants were expected to have chosen a technological tool that would enrich learning and transform their pedagogical practices as well. All the participants fell short of this technological pedagogical knowledge. Trucano (2005:1) asserts that integrating computers in teaching and learning transforms teachers' pedagogical practices. In fact, the knowledge of a choice of the appropriate technological tool informs the choice of a teaching method. Furthermore, this knowledge gives rise to the art of teaching, which assists in the better understanding of the subject matter. Koehler and Mishra (2009:4) also emphasise that the combination of an appropriate technological tool and the choice of a method provide better understanding of the subject matter. Photo 5.5 exemplifies this.

The exclusion of teaching methods in all lesson plans showed a lack of participants' technological pedagogical knowledge. As the findings above have shown, that the participants were able to choose appropriate ICT tools for their lesson presentations, there is a need to make them aware that a successful lesson presentation could be achieved through the choice of a teaching method linked to a suitable ICT tool. In a

technology-integrated lesson, a teaching method is expected to be transformed by a selected technological tool (Koehler & Mishra, 2006:1028).

5.4.2.4 The participants' technological content knowledge

Pertaining to technological content knowledge, the findings revealed that all the participants were conversant with their content knowledge. However, my focus was also on how they could manipulate this content through integrating ICTs in their lesson presentations. The findings revealed that some of the participants fell short of manipulating content through ICT usage.

All the participants except three (teacher A from school A, teacher G and teacher H from school D) manipulated their content through the use of appropriate technological tools. This was evident as they navigated through the different software they had selected, and every now and then, as they clicked different functionalities of software, the content changed the structure and this made the lesson presentations more interesting and appealing to their learners. Photo 5.5 (teacher C from school B) is an example of such lesson presentations. In essence, in a technology-integrated lesson an in-depth content knowledge assists teachers to select a suitable technological tool. Teachers are also expected to showcase the mastering of the two components (technological and content knowledge). According to Koehler et al. (2007:743) and Koehler and Mishra (2006: 1028), TCK demonstrates the substance of better understanding content through integration of ICTs. On the whole, the observation findings showed the need to train teachers on how to master the unique knowledge emphasised in TPACK in order to effectively integrate ICTs in teaching and learning. The participants' ICT qualifications provided in section 2 (biographical information) indicate minimal ICT qualifications, which also contributed to the weakness of this unique knowledge.

The following four photos are the examples of some of the participants' technology-integrated lesson presentations in both limited and rich ICT resource environments.

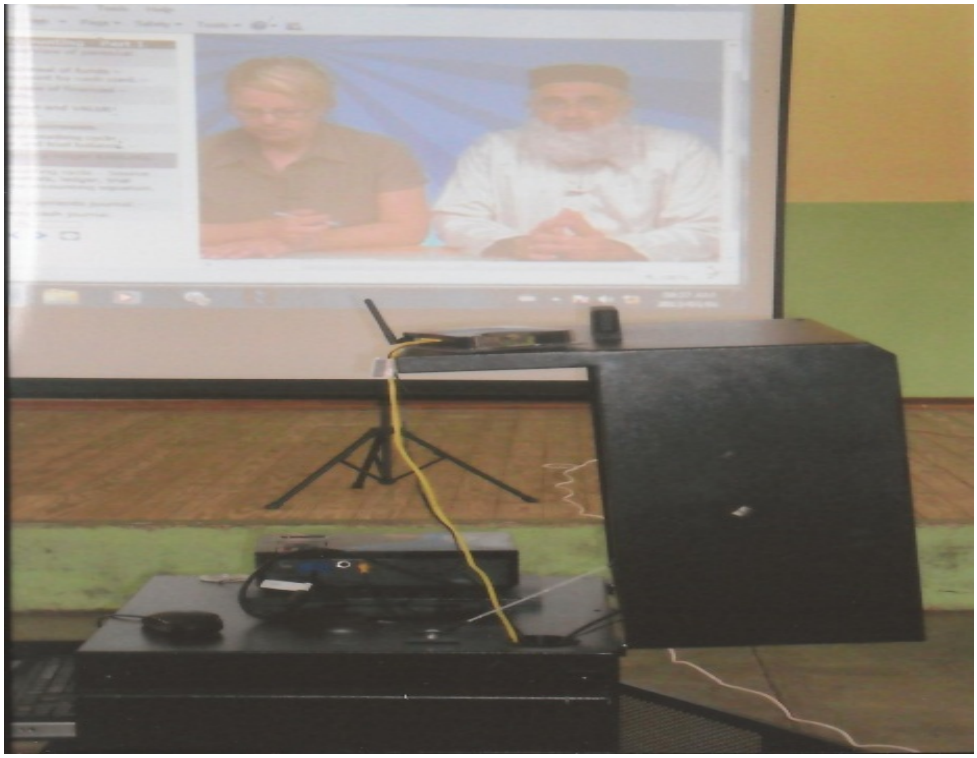


Photo 5.3 Accounting lesson presentation through DVD

Photo 5.3 shows an Accounting lesson presentation through the use of a digital video disc (DVD) by teacher A from school A. The theme of the lesson was cash transactions. Teacher A introduced the lesson by explaining what was meant by a cash transaction. Thereafter, learners were instructed to watch a DVD which clarified cash transactions. As the lesson unfolded, learners were instructed to take notes. The whole session took the form of watching the projected lesson presentation onto a white board and simultaneously jotting down notes. This was not a recommended manner for a teacher to facilitate a technology-integrated lesson. The lesson presentation verifies limited teachers' ICT competencies as stressed by Desjardins et al. (n.d.:214).

Photo 5.4 Teacher A lesson presentation

Photo 5.4 is the same lesson presentation delivered by teacher A (from school A). This photo shows learners watching a DVD presentation and concurrently jotting down notes. Learners kept on writing the notes and at the end of the lesson presentation teacher A used the chalkboard to further explain cash transactions. The method of teaching was therefore teacher centred. Learners listened attentively as teacher A imparted knowledge. Information was transmitted into their minds through the use of DVD and the teacher himself. UNESCO (2010: 6) in Chapter Three emphasises how the teacher's role should be transformed in the 21st century (refer to table 3.3).

Photo 5.5 below displays teacher C's lesson presentation.

Photo 5.5 Teacher C's lesson presentation

The following non-participant observation session took place in a classroom. ICT infrastructure was prepared in advance for the lesson presentation. The lesson was for the Grade 10 Mathematics learners. The theme was equations and inequalities. Teacher C from school B conveyed the lesson by means of a PowerPoint presentation and also used the installed Microsoft Math software (Linear Programing video clip) as another technological tool to enhance the teaching and learning of equations and inequalities. The two technological tools were interchangeably used throughout the lesson presentation. Learners observed attentively as teacher C navigated through the software and used the PowerPoint application program concurrently.

The choice of a slide show presentation enhanced the lesson and motivated learners to learn. The linear programing video clip attracted learners' attention and they were amused as their teacher typed in equations on a space provided in the software links and the graph was automatically drawn. Learners' responses to the questions asked demonstrated the understanding of the concept which was presented through the use of ICTs. This was an inspirational lesson presentation as teacher C

demonstrated his ICT expertise by navigating through the software. The only weakness of the lesson was that learners did not get the opportunity to practise hands-on technology. Further enrichment was achieved by instructing learners to watch the Maths equation video clip.

Photo 5.6 shows lesson presentation whereby learners were engaged in hands-on technology.

Photo 5.6 Teacher E's lesson presentation

The lesson presentation above was done in a computer laboratory by teacher E (from school C). It was Grade 11 on Life Orientation (LO) and the theme was physical fitness and health programs. Teacher E introduced the lesson by exploring learners' prior knowledge. The software was already downloaded to learners' desktop computers so that the icon for Body Mass Index (BMI) appeared on each desktop computer monitor. Learners were then instructed to access the BMI site, which was the activity of the lesson. Some learners struggled to gain access to the BMI site but teacher E came to their rescue.

ICT was integrated as learners interacted with the installed BMI software and every time followed instructions on what they were expected to do. They were then instructed to open up the word processing application program and the two programs (word processing and BMI) were interchangeably used by both computer users (learners and teacher E as the facilitator). Next, teacher E instructed learners to copy and paste information from the BMI site to a word processing application program. Learners were also instructed to minimise and also to do shortcuts through the keyboard functions.

Furthermore, learners were instructed to click on shortcut links on the BMI site time and again and thereafter were further instructed to do other functions which involved formatting of a document and searching for key words. They also had to summarise important information, and copy and paste it in a word processing document. There was a lot of interaction in this lesson as mentioned above. At the end, the assessment was done through a task provided to learners to ensure that they understood the theme. This was a hands-on technology lesson presentation as learners were given the opportunity to navigate through the software and operated the word processing application program. The document analysis strengthens the other two data gathering strategies. The discussion follows below.

5.4.3 The findings from the document analysis

The following documents were analysed: minutes of staff meetings, records of strategy for the implementation of ICTs in classroom practices and the participants' lesson plans that demonstrated the integration of technology. The aim was to find out whether the schools' staff members discussed the use of ICTs in the staff meetings or to find any information that indicated the integration of ICTs. It was also essential to establish whether the schools had a strategy, a policy, a plan or a vision for the implementation of ICTs in teaching and learning. With regards to the lesson plans I needed to ascertain whether participants integrated the technology in the lessons activities daily or whether they prepared technology-integrated lessons only for the non-participant observation sessions. The findings are tabulated below and then later discussed.

Table 5.3 The findings of the participants' support from schools

Schools	The school's ICT implementation strategy / policy	The school's staff minutes	Participants' technology integrated lessons
School A	No strategy No e-Education policy No ICT school policy	The staff members were encouraged and reminded to use ICT in teaching and learning by the site manager. The staff members were requested to use e-learning unit machine by the site manager.	TA submitted CAPS lesson preparation and TB submitted NCS lesson plans provided by subject advisors.
School B	No strategy No e-Education policy No ICT school policy	There were noted ICT equipment donated to the school. The site manager motivated staff members to use ICTs in teaching and learning.	TC and TD submitted CAPS draft lesson preparations.
School C	No strategy No e-Education policy No ICT school policy	The staff members were requested to use computers to enhance teaching and learning. Teachers were requested to attend ICT workshops.	TE submitted CAPS lesson preparation but also requested assistance on how to structure a technology–integrated lesson plan. TF submitted neither lesson plan nor lesson preparation.

School D	No strategy No e-Education policy No ICT school policy	Teachers were requested to attend ICT workshops.	TG and TH submitted NCS lesson plans which were provided by a subject advisors.

The table above reveals the absence of strategies on how to implement ICTs in teaching and learning in all the schools. Furthermore, a school's ICT policy or a South African e-Education policy was not available in all schools. According to the Department of Education (2004:17), all South African learners were expected to be technologically savvy by 2013. The cause of concern was that schools were expected to integrate ICTs in teaching and learning, yet they were without any documented guidelines on how to do it. The schools could have been provided with this policy in order to understand what was expected of them in terms of ICT implementation.

Although the selected secondary schools in this study did not have the ICT policies or a strategy that mapped the ICT implementation, at least the findings showed that in staff meetings teachers were reminded, motivated and even requested by their site managers to use computers in teaching and learning. Also, staff meeting minutes indicated that the site managers requested teachers to attend ICT workshops. This showed a positive attitude displayed by the site managers as far as the use of ICTs in teaching and learning was concerned. The supply of e-learning units at school A and ICT devices at school D motivated teachers to start using the schools' available ICT tools in their classroom practices.

The findings on the submission of technology-integrated lesson plans showed a lack of knowledge on how to structure them. Worst of all, the participants used ready-made lesson templates which were provided by their education specialists (refer to appendix 12 as an example). One of the participants (teacher E from school C) had openly indicated a need to be trained on how to do it.

At the time of conducting this study, the month of May 2013 was declared an ICT month at the participants' APO and this was discussed in one of the meetings. A

group of teachers in this APO was selected to pilot this event. I received no further information pertaining to this event.

The Grade 12 learner's report (refer to appendix 13) evidenced progress and acknowledgement of the attendance at a computer training session which was held at school A. This computer training was organised by the neighbouring mine and it aimed at orientating learners to the use of computers. The main aim with the use of the computers was to teach learners how to switch on a computer, how to create, open and save a file, to browse the internet and other basic functionalities of computers. The name of the learner and school A's name were concealed to maintain anonymity in this study.

5.4.4 The triangulation within data collection strategies

The data collection strategies that I used (semi-structured interviews, non-participant observation and document analysis) yielded different perspectives concerning teachers' ICT competencies in classroom practices. Rothbauer (2008:2) agrees to this notion as he attests that different data collection strategies produce different perspectives pertaining to the phenomenon under scrutiny. However, there were some other instances where the three strategies' findings converged, showing credibility in the study. The following figure represents triangulation within the findings:

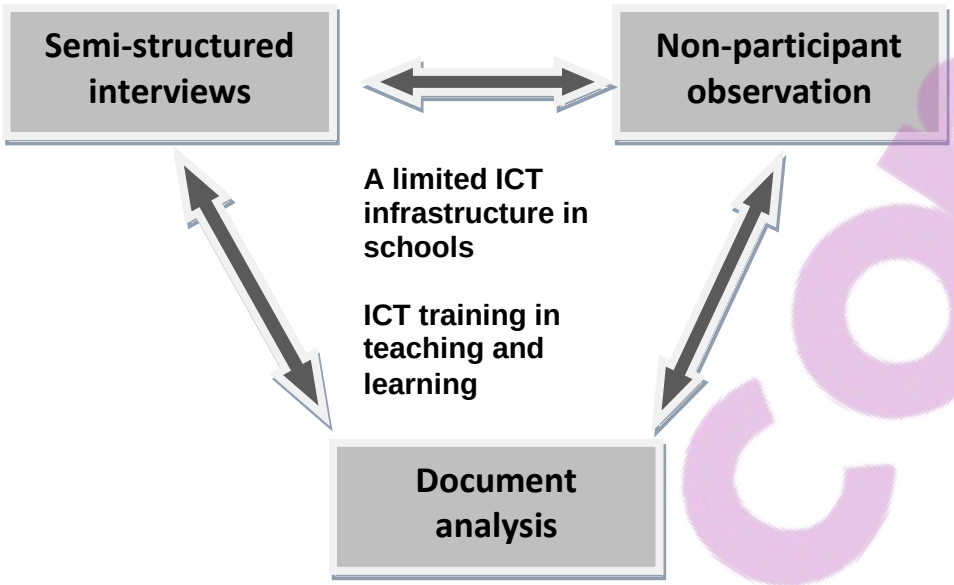


Figure 5.1 Triangulation of data collection strategies

As shown in the illustration above, the three data collection strategies revealed common findings as participants were unable to effectively integrate ICT in teaching and learning. There was limited ICT infrastructure in schools (refer to 5.4.1.2 semi-structured interviews, 5.4.2.4 non-participant observation and 5.4.3 document analysis). The lack of teacher training on the ICT implementation schools was one other common factors (refer to sections 5.4.1.1 semi-structured interviews, 5.4.2 non-participant observations and 5.4.3 document analysis).The next section concludes this chapter.

The next section concludes this chapter.

5.5 CONCLUSION

This chapter has presented the findings of this study. The findings were presented in three sections according to the data source types. The first section presented the orientation to the research settings, the second section presented the biographical information of the participants, while in section three the participants' shared views were interpreted, analysed and discussed. Photos and other appendices were used to enhance the findings. It can be concluded from the findings that secondary-school

teachers' ICT competencies to effectively integrate ICTs in teaching and learning are limited. The next chapter concludes the study.

CHAPTER SIX
SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

6.1 INTRODUCTION

This chapter concludes the journey that was undertaken in this study to investigate secondary-school teachers' ICT competencies in classroom practices. The chapter commences with a summary of all five chapters and subsequently highlights the main findings of this study and the suggested strategy for effective integration of ICT in teaching and learning. The limitations of the study that might have affected the achievement of its purpose and the answering of the research questions are then considered. It is imperative for me to make suggestions towards further studies rectifying the ICT deficiencies that need attention. Finally, I present recommendations and my reflection on the entire journey. The summary of the chapters of this study follow. This summary is presented in relation to the research objectives to affirm their achievement.

6.2 SUMMARY OF THE CHAPTERS OF THE STUDY

6.2.1 Chapter One

Chapter One is a realistic Geographical Positioning System (GPS) which guided me as the researcher to a predetermined journey of this study. The chapter presents a synopsis of secondary-school teachers' ICT competencies in classroom practices and includes an introduction, a survey use of ICTs worldwide, the problem context, problem statement, main research question, sub-questions, and aims and objectives. In addition, I discuss the motivation for and significance of the study, provide a preliminary literature review, and sketch the conceptual and theoretical frameworks underpinning this study. Finally, I offer a brief explanation of the research design,

ethical considerations, measures to ensure trustworthiness, the plan of the study and lastly the definitions of terms.

6.2.2 Chapter two

This chapter explained the epistemological interpretive paradigm in which this study was grounded. The secondary-school teachers' unique ICT knowledge was viewed through the TPACK conceptual framework and connectivism. I clarified why these frameworks best suited this study. Subsequently, the chapter placed TPACK in the classroom context to better explore and understand secondary-school teachers' ICT competencies. Connectivism emphasised the notion of information sharing through social networking tools. The two frameworks were further discussed to find out how they contributed towards secondary-school teachers' ICT competencies.

6.2.3 Chapter three

Chapter Three discussed other authors' views concerning teachers' ICT competencies in classroom practices. The main question was concerned with the use of ICTs in education. The answer involved deliberations as to how the education system could be transformed through the use of ICTs. The use of ICTs in South Africa is part of this chapter and was compared to those used in American classroom activities.

The South African ICT initiatives were included to find out what measures were put in place that would support and encourage teachers to integrate ICTs in their teaching and learning. An investigation regarding secondary schools teachers' ICT knowledge was explained in detail.

The UNESCO ICT competency framework for teachers offers guidance for the implementation of ICTs in teaching and learning. The chapter concluded with a discussion of teachers as agents of change, the expectations concerning the integration of ICTs in teaching and learning as well as implementing supportive measures for teachers.

6.2.4 Chapter four

Chapter Four detailed on the research design used in this study, which was based on empirical evidence and the paradigm stance was from an epistemological interpretive perspective. The choice of a research plan in a study explains the type of methodology used, hence the choice of an epistemological interpretive paradigm perspective in this study necessitated the use of a qualitative research method. A case study was used as the research design, which included multiple cases. The selected secondary schools were the cases in this study and hence I described each school to give a clear picture of where fieldwork was done.

The selection of data collection and analysis strategies was considered next. The gathering of data was done through face-to-face interaction with participants, who were informed about their rights and protection as participants of this study in accordance with ethical considerations. Ensuring trustworthiness through credibility, transferability, dependability and confirmability was also part of this chapter.

6.2.5 Chapter five

Included in this chapter was a detailed presentation of the collected data, which was divided into three sections. Section one gave an account of this study's context; section two focused on the biographical information of the participants; and section three presented data analysis, interpretation and the discussion of the findings of the study.

6.3. SUMMARY OF THE MAIN FINDINGS

The main aim of this study was to investigate secondary-school teachers' ICT competencies in classroom practices in order to suggest a strategy for integrating ICTs in teaching and learning. The objectives were to: determine the extent to which secondary-school teachers integrate ICT in classroom practices; explore the challenges that secondary-school teachers experience when they integrate ICT in classroom practices; and suggest the strategy that secondary-school teachers can

use to integrate ICT in classroom practices. The main findings of this study are discussed in line with the study objectives.

6.3.1. How do secondary-school teachers integrate ICT in classroom practices

The findings from semi-structured interviews revealed a lack of ICT experience by teachers, inadequate infrastructure, and the outsourcing of ICT implementation services. These are further discussed in the next sections.

6.3.1.1 The participants' ICT experience in teaching and learning

It was apparent from the study that most participants had limited ICT experience in teaching and learning, exacerbated by their minimal ICT qualifications. Lack of ICT experience and qualifications become barriers to effective integration of ICTs in teaching and learning.

6.3.1.2 The available ICT infrastructure in the selected secondary schools

Again, this study discovered that the selected secondary schools had inadequate ICT infrastructures which could play a vital role in the enhancement of teaching and learning. The deficient ICT infrastructure could be a barrier to the successful use of technological devices in classroom practices. As mentioned in Chapter Two of this study, technological knowledge in the TPACK conceptual framework emphasises the availability of ICT infrastructure coupled with teachers' knowledge of how to operate such tools as a priority in the implementation of ICTs in teaching and learning. Apart from schools C and D, the other selected secondary schools operated in limited ICT resource environments. This environment did not provide the participants with the opportunity to explore various ICTs for appropriate choices in their technology-integrated lesson presentations. Accessibility to the Internet in schools was also restricted. Hence, some participants requested learners to use their cell phones to search for information. In addition, most of the participants were unfamiliar with the upgrading of software. Limited ICT resource environments minimise teachers' use of ICT due to the following reasons:

- teachers are ill-informed about the various ICT tools;

- inaccessibility of the internet prevents sharing of information through social networking tools and other communication tools such as emails; and
- teachers are not knowledgeable about the upgrading of software.

6.3.1.3 The implementation of ICTs in teaching and learning

The findings indicate that most of the selected secondary schools outsourced the services. Most of the selected secondary schools outsourced the services and this verifies the absence of ICT implementation strategies or policy. In essence, secondary schools should have strategies guiding them throughout the integration of ICTs in their curricula. Without documented guidance ICT implementation could prove problematic.

6.3.1.4 The installation of software in computers

The findings illustrated that participants did not possess the required skills to install software in computers. Their lack of knowledge in software installation prevented them from using technology to help solve their educational tasks and challenges. The National Curriculum Statement (NCS) in some instances has lesson outcomes that are impossible to achieve without the use of ICTs. Hence, some South African teachers are obliged to use ICTs in teaching and learning as is the case with Geographical Information System (GIS) in Geography.

6.3.1.5 The use of ICTs and the purpose of application programs in teaching and learning

The findings indicated that participants were knowledgeable about the various application programs but they did not know how to integrate these tools in teaching and learning. This gap needs to be taken into cognisance as technology is moving at a fast pace and many South African teachers might find themselves becoming obsolete in their profession. Teachers are expected to catch up before the traditional approach to teaching becomes redundant; integration of ICTs in teaching and learning is becoming the advanced teaching approach in the 21st century.

6.3.1.6 The social networking tools

The participants showed weakness in engaging social networking tools in classroom practices. The Connectivism theoretical framework mentioned in Chapter Two (refer to section 2.3) highlights the benefits of sharing information through social networking tools. The use of such tools in teaching and learning would lessen teachers' difficulties of motivating learners to learn because the 21st-century learners are fascinated by online chatting. Then learners would be encouraged to take control of their learning.

6.3.2. The challenges experienced by secondary-school teachers when integrating ICT in classroom practices.

The observation of lesson presentations which integrated ICTs highlighted some challenges, namely flaws in technology-integrated lesson preparations, the participants' potential to showcase their technological knowledge, technological pedagogical knowledge and technological content knowledge, and lack of support to effectively integrate ICTs in classroom practices. These flaws are further discussed in the next sections.

6.3.2.1 The technology-integrated lesson preparation

The findings indicated a flaw in terms of planning or preparing a technology-integrated lesson. Most of the participants relied on the ready-made lesson templates which were provided by subject advisors. Surprisingly, they were able to select suitable ICT tools for their lesson presentations but they failed to effectively integrate these tools in their lesson presentations.

Furthermore, the participants lacked the unique knowledge emphasised by TPACK that would enable them to effectively integrate ICTs in their classroom activities. This unique knowledge, as mentioned in Chapter Two (see section 2.4) of this study, refers to the combination of three components that produce a truly meaningful and deeply-skilled knowledge needed by teachers to effectively integrate technology in teaching and learning. They are discussed below.

6.3.2.2 The participants' technological pedagogical and content knowledge

In this study, the findings showed that the participants' choice of appropriate technological tools was precise but the challenge was how to showcase their ICT expertise in integrating such tools in teaching and learning. Again, most of the participants fell short of technological pedagogical knowledge because they could not transform their teaching methods (pedagogies) through the selected technological tools. I also discovered that the technological content knowledge was a challenge to the participants. Although most of the participants had content knowledge, still they could not manipulate such content through ICT usage. This achievement remained a challenge. Based on the above discussions, it is true that the participants the lacked unique knowledge emphasised by TPACK to effectively integrate ICT in teaching and learning.

6.3.3 Lack of support to effectively integrate ICTs in classroom practices

The findings from the analysed documents revealed a lack of support from the strategy or policy that could guide them in ICT implementation in their schools. The strategy or policy provides a route that can aid teachers in terms of ICT implementation. Remarkably, all the selected schools did not possess such guidance. The South African e-Education policy contains guidelines on the integration of ICTs in teaching and learning but the selected schools lacked support and had not been supplied with this document.

6.3.4 The strategy for effective integration of ICT in teaching and learning

In a school setting, the school's stakeholders should embrace or have a shared vision regarding improving learners' performance with technology. Undoubtedly, if all stakeholders have a vision and get involved in the planning of the use of ICTs in teaching and learning, the whole process could be a success. Figure 6.1 illustrates a strategy for schools to implement ICT in teaching and learning.

Figure 6.1 A strategy for ICT implementation in a school

As illustrated in the above figure, the suggested strategy for ICT implementation proceeds as follows:

First Step: ICT Infrastructure needs analysis

In this step the ICT needs analysis in a school could be done to find out the available ICT infrastructure for effective teaching and learning, and how it can be employed, purchased or sourced through donations.

Second step: analysis of teachers' ICT competencies

Teachers' ICT literacy should be analysed to find out their level of ICT competencies. Conducting a needs analysis of teachers' ICT competencies would enable a school to set up aims and objectives and define the means of attaining them at the end of a

targeted time. The needs analysis, aims and objectives inform the design of a school's ICT policy, which has to be aligned to the South African e-Education policy.

Third step: drafting of training manuals

The school's curriculum should inform the choice of ICT infrastructure. With this background information, training manuals can be drafted. The training of teachers on how to effectively integrate ICTs in teaching and learning can be initiated by a competent ICT user. This should not be a once-off training but an on-going process in order to ensure continuity and assist teachers when the need arises.

Fourth step: follow-up sessions

This step should be about follow-up sessions to discover weaknesses and strengths in the implementation process and ways of improving the strategy. The school can also appoint or have an ICT coordinator who is responsible for guiding teachers and learners on all ICT-related issues. A yardstick in the form of assessment has to be put in place to compare what happened before teachers integrated ICTs in teaching and learning and after the implementation of ICTs in their classroom practices. Contact with schools that have successfully implemented ICT in teaching and learning would also assist in terms of learning from the best.

6.4 THE LIMITATIONS OF THE STUDY

Despite careful planning on how to conduct this study, pitfalls were also experienced. There was no consistency in data gathering through all data collection strategies. The plan was to conduct semi-structured interviews at all four selected secondary schools within a specified timeframe. However, this did not work out according to plan, as many appointments with participants had to be rescheduled on numerous occasions. Due to unforeseen circumstances such as the constant rescheduling of appointments, valuable time was wasted. Efforts to use semi-structured interviews for all participants within a specified timeframe became an unattainable objective. That being the case, the non-participant observation sessions were conducted concurrently with the semi-structured interviews.

Document analysis became a tedious process, as one of the secondary schools was exceptionally slow in relaying their information for the purpose of data collection. From a positive point of view, an opportunity appeared while waiting for the school's information: it provided extra time to further study and better understand the phenomenon. In addition, discussing the implementation of CAPS may have unintentionally led the focus away from the study's intended objectives. The participants cooperated well in non-participant observation sessions when they presented their technology-integrated lessons. There seemed to be a great deal of confusion when requesting their previous technology-integrated lesson plans as they were unsure as to whether to follow the old or the new NCS assessment plan. Not enough research is being conducted regarding the topic of this study as most researchers focus mainly on how teachers use ICTs in teaching and learning instead of directing their attention to the teachers' ICT competencies. Suggestions for further study follow below.

6.5 SUGGESTIONS FOR FURTHER STUDY

The results of this study reflect shortcomings in the usage of ICTs that require attention. The South African e-Education policy has been formulated but there seems to be no concrete information regarding its efficacy in the education system as a whole. For this reason, in addition to this study other valid and reliable research should be conducted to ascertain whether and how the policy has transformed the South African education system.

Training of teachers in the use of ICT for teaching and learning is not only the responsibility of the Ministry of Education. Teacher training is done by Higher Education Training (HET) institutions. Thus, research should be conducted to assess the quality of the ICT part of such teacher training programmes.

In addition, it is vital to conduct research on the efficacy of the Thutong portal as an ICT communication tool which is made accessible by the South African Government to assist South African teachers in imparting skills, knowledge and scholastic information in their teaching.

Lastly, a study should be conducted to establish whether the integration of ICTs in teaching and learning does in fact improve learners' performance in secondary schools. The recommendations for this study are set out below.

6.6 RECOMMENDATIONS

- Secondary-school teachers should be technologically knowledgeable, supplied with ICT infrastructure, and be equipped with ICT competencies.
- Secondary-school teachers should attend workshops about how to plan technology-integrated lessons and should be equipped with the unique knowledge emphasised by TPACK.
- Secondary schools should have their own policies or strategies regarding the implementation of ICT in teaching and learning. These policies or strategies should be linked to the South African e-Education policy.

In conclusion, I turn to my reflections on this study.

6.7 REFLECTIONS

In this study, I witnessed the participants (secondary school teachers) demonstrating their ICT competencies. I would have liked to include the site managers, as they might have contributed more towards the wealth of information regarding teachers' ICT competencies. This was verified by the impromptu interview at school C, which reflected the site managers' perspective concerning the use of ICTs in teaching and learning. The site managers should be technologically knowledgeable and understand what is expected of them as the leading figures responsible for the implementation of ICT in schools. According to the Department of Education (2004:17), all South African learners should have been technologically competent by 2013. Hence, the site managers were expected to have taken implementation steps in this regard.

This study was conducted at the right time in 2013 as schools within the APO were pressurised to integrate ICT in teaching and learning. This implementation plan was confirmed by the ICT conference which was organised by the district subject advisory coordinator where this study took place. I was invited to give a presentation on the use of ICTs in schools at this conference (refer to Appendix 9, conference programme).

In addition, the site manager at school B was concerned about infrastructure and was unaware of alternative means of overcoming challenges. In essence, the integration of ICTs in teaching and learning depends on the availability of ICT infrastructure in a school. As a former CAT teacher, I know that computer laboratories play a pivotal role for some teachers and site managers in the use of ICTs in teaching and learning. However, in my experience teachers assume that a computer laboratory is the only route to integrating ICTs in teaching and learning; therefore, their frame of mind needs to be altered. Teachers should be exposed to the various ICT devices that can encourage them to engage in a 21st-century approach to teaching and learning indicated by authors as technological knowledge (Koehler & Mishra, 2009:4; Koehler et al., 2007:743).

In the process of conducting this study, I realised that technological knowledge plays a major role compared to other ICT competencies. There are cases where technology was used in both an environment (schools) with limited resources and a resource-rich environment (schools). Indeed, infrastructure plays a major role in this regard, but it does not necessarily mean that the computer laboratory is the only appropriate environment that can be employed to enhance teaching and learning. There are numerous means that teachers can employ to enrich teaching and learning, and indeed, this is dependent on how knowledgeable they are regarding the choice of technological devices.

At school C, a Computer Application Technology (CAT) teacher was selected to participate in the study. Interestingly, the site manager was unaware that this teacher was allocated to offer CAT only. I did not accept CAT as a subject to be observed as it was already a technology-integrated subject. The rationale behind this study was

to investigate teachers' ICT competencies through engaging other subjects which were not technologically integrated. In my experience, CAT teachers integrate ICT in teaching and learning daily and are not dependent on the curriculum like teachers who willingly integrate ICTs in teaching and learning. Hence, the findings might not have been legitimate if I had included CAT as a subject for observation.

The lesson presented by the CAT teacher using other subjects and not CAT was an eye-opener to me. I realised that a CAT teacher, like any other teacher, needs the unique knowledge identified in the TPACK conceptual framework to effectively integrate ICT in his/her classroom activities of other subjects and not CAT. According to the National Curriculum Statement of South Africa, CAT is a technology-integrated subject. In other words, as CAT teachers prepare their lessons, they need not worry about the choice of appropriate ICT tools, because CAT themes have already included the appropriate ICT tools. Hence, when they integrate ICT in other subjects the choice of an appropriate technological tool might become a challenge to them.

Something that intrigued me during the observation sessions was the manner in which the participants demonstrated their ICT competencies. The participants employed the available ICT infrastructure in their classroom practices. The computer laboratories in two schools (schools A and C) had been vandalised. All the computers and other ICT tools in their computer laboratories had been stolen. Fortunately, this did not deter them from using the available ICTs in teaching and learning and they went an extra mile to enhance their classroom activities. Some participants did not mind the scarcity of ICT tools but instead had picked up the pieces and continued with the integration of ICTs in their classroom practices. Other participants had not acquired the required or relevant ICT qualifications which would have enabled them to integrate ICT in teaching and learning, but had a passion for ICTs usage instead.

The donation of ICT infrastructure was a common practice in most schools within the APO where this study was conducted. This was another factor that prompted me to conduct this study. Indeed, it was a good practice initiated by ICT infrastructure donors, but training regarding the use of technological devices was not included. For

instance, teachers were not capacitated on how to use the e-learning unit machine which was donated to school A. If training were not provided to the users, only dedicated teachers would use ‘trial and error’ methods until they have mastered the operation of a tool. Certainly, this would deny other teachers the use of ICTs in teaching and learning because nothing would compel them to take the initiative.

The integration of ICTs in teaching and learning should be a hands-on technology. Each learner should have his or her own work station from which to operate, with the teacher facilitating the process. Most of the participants managed to showcase their technological knowledge in lesson presentations but failed to engage learners in hands-on technology. This implies that a learner should have a computer as a personal belonging, the same way as they have their own notebooks to use for writing. They should know where captured information is saved, where to find folders and how to organise information. This gives them an opportunity to explore computers’ functionalities and imitate a teacher’s technological expertise as well. In this context, the approach develops their 21st-century skills. The interaction between teachers and learners should no longer be face-to-face but through technology, content and a facilitator. Throughout the most observed technology-integrated lessons, learners were passive recipients of information from secondary school teachers. This was another challenge which showcased limited teachers’ ICT competencies.

My study has made me realise that some teachers still prefer their comfort zone of using the traditional teaching and learning method. The integration of technology in teaching and learning will soon be indispensable because the technology devices are constantly being upgraded. Hence, teachers will in the future most probably be forced to change their teaching methods and adopt a new teacher’s role emphasised by UNESCO (2010:6) as outlined in Chapter Three.

In my research journey, I also realised that most participants who use ICTs in teaching and learning were science teachers. The teaching of other subjects needs to be enhanced through ICT usage. In essence, the whole education system should be reviewed to develop learners’ 21st-century skills. Furthermore, it does not

necessarily mean that integration of ICTs in teaching and learning should be done daily, except in the case of subjects like CAT and IT. ICT integration can also be done whenever the need in the curriculum arises.

6.8 CONCLUSION

A long journey has now been completed. This chapter finalises the investigation of secondary-schools teachers' ICT competencies. The summary of each chapter enables the readers to reflect on the entire study. The discussion of the summary of the findings is significant, indicating how the objectives of the study have been successfully achieved.

The strategy for effective integration of ICT in teaching and learning in this chapter gives guidance for implementation of ICTs in a school setting and explains how teachers can be assisted to integrate and improve their pedagogical practices with technology. However, the unexpected hiccups along the way could have jeopardised the accomplishment of the intended objectives. Thus, the limitations of the study give the readers an idea of the events throughout the study that could have hindered the achievement of the expected results. As the study progressed, I was able to pinpoint gaps and loopholes that necessitate further studies for the attention of researchers.

Further studies are essential as new information can come to light contributing towards the current body of research knowledge. In the end, recommendations assist in bridging the identified gaps. My reflection pertaining to the entire study serves to conclude the investigation of secondary schools' ICT competencies.

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APPENDICES

Appendix 1

UNISA | college of education

Research Ethics Clearance Certificate

This is to certify that the application for ethical clearance submitted by

AR Molotsi
[47298871]

for a D Ed study
entitled

Secondary-school teachers' Information Communication Technology competencies in classroom practices

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 CS le Roux
CEDU REC (Chairperson)

20 March 2013

lrouxcs@unisa.ac.za

Reference number: 2013 MAR/ 47298871/CSLR

Appendix 2: The letter addressed to the Bojanala District Director requesting permission to conduct the study

University of South Africa
P. O. Box 392
UNISA
0003
18 July 2012

The Director
Bojanala District
Private bag X 82110
Rustenburg
0300

Dear Sir/Madam

RE: Request for permission to conduct a research in Bojanala District

I hereby make a humble request to conduct a research in Bojanala District. I'm a Doctoral degree student; the topic of my study is ***Teachers' Information Communication Technology (ICT) competencies in classroom practices***.

My target population is **secondary-school teachers** who integrate ICT in teaching and learning. Data collection will involve semi-structured interviews, non-participant observation and document analysis Teachers' information concerning the use of ICTs in classroom would assist me as a researcher to answer the following questions:

- How often do secondary-school teachers integrate ICTs in their classroom practices?
- What are the challenges experienced by secondary-school teachers when integrating ICT in teaching and learning?

- What support do secondary teachers receive to effectively integrate ICTs in teaching and learning?

My plan is to visit four schools which will be identified once this request has been approved. The results would assist to analyse and address the state of the use of ICTs in the district. I will also provide the district with a copy of my research upon completion of my degree.

Your positive response in this regard will be highly valued. Thanking you in anticipation.

Yours Truly

A.R.Molotsi (Mrs)

Signed.....

Enquiries: Abueng Rachael Molotsi

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072 358 9662

molotar@unisa.ac.za

Appendix 3A: The letter for the site manager requesting permission to conduct a study in the school

University of South Africa

Box 392

UNISA

0003

28 January 2013

The Site Manager

St Theresa Secondary School

Box 3581

Brits

0205

Dear Sir/Madam

RE: Request for permission to conduct a research in St Theresa secondary school

I hereby make a humble request to conduct a research in the above mentioned school. I'm a Doctoral degree student at UNISA; the topic of my study is **Secondary-school teachers' Information Communication Technology (ICT) competencies in classroom practices**.

My target population is **secondary-school teachers** who use technology in teaching and learning. Data collection will involve semi-structured interviews, non-participant observation and document analysis. Teachers' information concerning the use of ICT in classroom would assist me as a researcher to answer the following questions:

- How do secondary-school teachers integrate ICT in their classroom practices?

- What are the challenges experienced by secondary-school teachers when integrating ICT in classroom practices?
- What support do secondary-school teachers receive to effectively integrate ICT in teaching and learning?

The results would assists to analyse and address the state of the use of ICTs in the district. I will provide the school together with the district a copy of my research upon completion of my degree.

Your positive response will be highly valued. Thanking you in anticipation.

Yours Truly

AR Molotsi (Mrs)

Signed.....

Enquiries: Abueng Rachael Molotsi

Tel: (012) 429 3265 (W)

(012) 546 2275 (H)

Cell: 072 358 9662

E-mail: molotar@unisa.ac.za

Appendix 3B: The letter for the site manager requesting permission to conduct a study in the school

University of South Africa

Box 392

UNISA

0003

28 January 2013

The Site Manager

Tsogo Secondary School

Box 911 350

Rosslyn

0200

Dear Sir/Madam

RE: Request for permission to conduct a research in Tsogo secondary school

I hereby make a humble request to conduct a research in the above mentioned school. I'm a Doctoral degree student at UNISA; the topic of my study is ***Secondary-school teachers' Information Communication Technology (ICT) competencies in classroom practices***.

My target population is **secondary-school teachers** who use technology in teaching and learning. Data collection will involve semi-structured interviews, non-participant observation and document analysis. Teachers' information concerning the use of ICT in classroom would assist me as a researcher to answer the following questions:

- How do secondary-school teachers integrate ICT in their classroom practices?

- What are the challenges experienced by secondary-school teachers when integrating ICT in classroom practices?
- What support do secondary-school teachers receive to effectively integrate ICT in teaching and learning?

The results would assists to analyse and address the state of the use of ICTs in the district. I will provide the school together with the district a copy of my research upon completion of my degree.

Your positive response will be highly valued. Thanking you in anticipation.

Yours Truly

AR Molotsi (Mrs)

Signed.....

Enquiries: Abueng Rachael Molotsi

Tel: (012) 429 3265 (W)

(012) 546 2275 (H)

Cell: 072 358 9662

E-mail: molotar@unisa.ac.za

Appendix 3C: The letter for the site manager requesting permission to conduct a study in the school

University of South Africa

Box 392

UNISA

0003

28 January 2013

The Site Manager

Malatse Motsepe Secondary School

Private Bag X 1039
Ga- Rankuwa
0208

Dear Sir/Madam

RE: Request for permission to conduct a research in Malatse-Motsepe secondary school

I hereby make a humble request to conduct a research in the above mentioned school. I'm a Doctoral degree student at UNISA; the topic of my study is ***Secondary-school teachers' Information Communication Technology (ICT) competencies in classroom practices***.

My target population is **secondary-school teachers** who use technology in teaching and learning. Data collection will involve semi-structured interviews, non-participant observation and document analysis. Teachers' information concerning the use of ICT in classroom would assist me as a researcher to answer the following questions:

- How do secondary-school teachers integrate ICT in their classroom practices?

- What are the challenges experienced by secondary-school teachers when integrating ICT in classroom practices?
- What support do secondary-school teachers receive to effectively integrate ICT in teaching and learning?

The results would assists to analyse and address the state of the use of ICTs in the district. I will provide the school together with the district a copy of my research upon completion of my degree.

Your positive response will be highly valued. Thanking you in anticipation.

Yours Truly

AR Molotsi (Mrs)

Signed.....

Enquiries: Abueng Rachael Molotsi

Tel: (012) 429 3265 (W)

(012) 546 2275 (H)

Cell: 072 358 9662

E-mail: molotar@unisa.ac.za

Appendix 3D: The letter for the site manager requesting permission to conduct a study in the school

University of South Africa

Box 392

UNISA

0003

28 January 2013

The Site Manager

Central Secondary School

P.O. Box 400

Brits

0250

Dear Sir/Madam

RE: Request for permission to conduct a research in Central secondary school

I hereby make a humble request to conduct a research in the above mentioned school. I'm a Doctoral degree student at UNISA; the topic of my study is **Secondary-school teachers' Information Communication Technology (ICT) competencies in classroom practices**.

My target population is **secondary-school teachers** who use technology in teaching and learning. Data collection will involve semi-structured interviews, non-participant observation and document analysis. Teachers' information concerning the use of ICT in classroom would assist me as a researcher to answer the following questions:

- How do secondary-school teachers integrate ICT in their classroom practices?
- What are the challenges experienced by secondary-school teachers when integrating ICT in classroom practices?

- What support do secondary-school teachers receive to effectively integrate ICT in teaching and learning?

The results would assists to analyse and address the state of the use of ICTs in the district. I will provide the school together with the district a copy of my research upon completion of my degree.

Your positive response will be highly valued. Thanking you in anticipation.

Yours Truly

AR Molotsi (Mrs)

Signed.....

Enquiries: Abueng Rachael Molotsi

Tel: (012) 429 3265 (W)

(012) 546 2275 (H)

Cell: 072 358 9662

E-mail: molotar@unisa.ac.za

Appendix 4

Informed consent letter for the participants

Topic: Secondary-school teachers' Information Communication Technology competencies in classroom practices.

Dear participant

The following information is provided for you to decide whether you wish to participate in this study. Please be aware that your participation is voluntary, you are free to withdraw at any time without affecting the process of conducting this study.

The purpose of this study is to investigate secondary teachers' Information Communication Technology (ICT) competencies in order to suggest a strategy that can be implemented to assist them to effectively integrate ICTs in teaching and learning. The procedure will be a multiple case study design. You are humbly requested to share your experiences and challenges in the use of technology or ICTs in teaching and learning. Again showcase or demonstrate how you use ICTs in teaching and learning. Lastly shed light on the support you get to effectively integrate ICTs in teaching and learning.

Data collection will involve semi-structured interviews, non-participant observation and document analysis. Interviews will take place not more than one hour and will be recorded through Samsung Galaxy Note II cell phone. Observation of Lesson presentation will be videoed. However, you are requested to give the researcher a permission to take a video of your presentation. The researcher will also record field notes not only about what happened during fieldwork but also reflections pertaining to what happened in the whole process of data collection sessions.

The following documents will be examined; minutes of the staff meetings, records of strategy of implementing ICTs in classroom practices and teachers' ICTs integrated lesson plans.

Please do not hesitate to ask questions about the study. Your school will be provided with the findings upon completion of the study. Be assured that your name will not be associated with the research findings in any way, and your identity as a participant will not be disclosed, there will be nowhere where you will be required to identify yourself. The information provided in this study will be kept confidential. There are no risks anticipated in this study.

I have read and understood the purpose and procedures of this study and agree to fully participate in this study

_____ _____

Signature of Participant Date

Appendix 5:

SEMI-STRUCTURED INTERVIEW QUESTIONS

QUESTIONS

The main question:

What are secondary schools teachers' ICT competencies in classroom practices?

Sub questions:

- How do secondary-school teachers integrate ICT in their classroom practices?
- What are the challenges experienced by secondary-school teachers when integrating ICT in teaching and learning?
- What support do secondary-school teachers receive to effectively integrate ICT in teaching and learning?

ICT COMPETENCIES

- **Technical , Information , Epistemology and Social order**

• **How do secondary-school teachers integrate ICT in their classroom practices?**
Questions and Responses
1. How long have you used ICTs in teaching and learning?
Response

2. What ICT infrastructure does your school have?
Response
3. How did your school implement ICTs in teaching and learning**?**
Response
4. How many times do you install application programme software?
Response
5. What background training do you have that enable you to use ICT in teaching and learning?

Response
6. What additional support do you require as a 21st-century teacher to effectively integrate ICTs in teaching and learning?
Response
7. Do you think ICTs have much to offer in teaching and learning?
Response
8. Do your colleagues use ICT in teaching and learning?

Response
9. Could you please share with me how you use the following programs in your teaching and learning activities:
9.1. Operate a word processing program(Word) Response
9.2. Graphic presentation (Power Point) Response

9.3. Spreadsheet program (Excel)

Response

9.4. Data base (Access)

Response

9.5. Social Media networking tools (twitter, facebook, mxit)

Response

9.6. Communication tools (email, chats whatsApp, blogs, wikis, mailing list)

Response

9.7. Thutong portal

Response

Appendix 6

NON-PARTICIPANT OBSERVATION CHECKLIST

What are the challenges experienced by secondary-school teachers when integrating ICT in teaching and learning?	YES	NO	DESCRIPTION/COMMENT
1. Does a lesson plan include the following? 1.1. Learning outcomes.			
1.2. Lesson outcomes.			
1.3. Assessment standards			

1.4. Scenario.			
1.5. Teaching strategy			
1.6. Technology and other resources.			

1.7. Teaching activity that integrates some form of ICT.			
1.8. Learning activity that includes some form of ICT.			
2. Presentation of a lesson plan			
2.1. Which ICT tool is the teacher engaging in his/her lesson presentation?			

2.2. Is the ICT tool appropriately selected for the lesson?			
2.3. Are teachers able to address ICT technical problems that they encounter in a technology-integrated lesson?			
2.4. Does the choice of an ICT tool assist in the achievement of			

lesson outcomes?			
2.5. Is the teaching strategy linked to the ICT tool?			

Appendix 7

DOCUMENT ANALYSIS CHECKLIST

What support do secondary-school teachers receive to effectively integrate ICT in teaching and learning? Does their teaching integrate ICT?			
• **ISSUE**	**RECORDS**		**COMMENTS ON DOCUMENTS**
	Yes	**No**	
3. Does a lesson plan include the following? 3.1. Learning outcomes.			
3.2. Lesson outcomes.			
3.3. Assessment standards			

3.4. Scenario.			
3.5. Teaching strategy**.**			
3.6. Technology and other resources.			
3.7. Teaching activity that integrates some form of ICT.			

3.8. Learning activity that includes some form of ICT.			
4. Is there any documented information pertaining to ICT training course, workshop or seminar.			
3. Are there ICT materials available which evidence the use of ICTs? (e.g. internet, hardware, educational and other software).			
4. Is there any evidence on			

how ICT was implemented in the school?			
5. Is there any ICT school-based policy or government ICT policy?			
6. Do staff's meeting minutes contain information about the use of ICTs in teaching and learning?			

Appendix 8

Response from the Bojanala District Director

education and training
Lefapha la Thuto le Katiso
Departement van Onderwys en Opleiding
Department of Education and Training
NORTH WEST PROVINCE

cnr Kock and Heystek Street,
Rustenburg 0299
Private Bag X82110
Rustenburg 0300
Tel.: (014) 590-4800
Fax.: (014) 592-3247
e-mail: dmohube@nwpg.gov.za

To: Ms A.R. Mmolotsi
UNISA

From: Ms M.P. Mokhutle
Director: Professional Support Services

Date 10 September 2012

Subject **Request for permission to conduct a research in Bojanala District**

Your correspondence with regard to the above-mentioned matter is acknowledged with thanks.

However, as preparations for the end of the year examinations have started it would be imprudent of us not to consider the significance of this period for both our learners and educators.

Please be kind enough to give us time to look into our schedule and determine how we can assist by meeting your request.

It is unfortunate that we cannot give you permission to conduct your research, this year, because of the reasons mentioned above, you will be granted permission to start in January 2013.

However, in the meantime identify the schools that you will work with, that will enable us to inform those schools.

Please contact Messrs S.M. Jacobs and T. Nkwe at 014 597 8678 for further engagement on this matter.

Thanking you

Mokhutle

Ms M.P. Mokhutle
Director: Professional Support Services

Cc: Ms D.E Mohube – Executive District Manager

DEPARTMENT OF EDUCATION
NORTH WEST PROVINCE
BOJANALA DISTRICT
2012 -09- 25
TEL: [illegible] FAX: [illegible] 592 3247
PRIVATE BAG X82110 RUSTENBURG 0300

Appendix 9: ICT conference programme

education
Lefapha la Thuto le Katiso
Departement van Onderwys en Opleiding
Department of Education and Training
NORTH WEST PROVINCE

6 Pendoring Street,
Brits, 0250
Private Bag X5082
Brits, 0250
Tel.: (012) 250-1910
Fax.: (012) 250-1904
e-mail: zboikhutso@nwpg.gov.za

OFFICE OF THE AREA MANAGER: MADIBENG AREA OFFICE

DYNAMIC EDUCATION FOR THE 21st CENTURY:

Focus on Maths, Science and Technology

5-6 March 2013

H/s Hartbeespoort

PROGRAM DAY ONE – 5 March		MC Mr. Marobe
8:00 – 8:25	Registration	AO staff
8:30 – 8:40	Opening & Welcome	Ms Aphane and Mr Le Roux
8:45 - 8: 55	Area Office welcome/guests	Mr Thema (acting AO manager)
8:55 – 9:10	Purpose of the conference: Education for the 21st century	Dr. J. Swanepoel
9:10 – 10:15	Theme: DISCOVER THE WOW IN EDUCATION	The Twitter Style
10:30 - 12:45	Back from H^2O break	M. Twitter Verster
12:45 - 13:15	*Light lunch*	
13:15 – 15: 30	You and TWITTER … LIVE!	Principals

DAY TWO – 6 March		MC: Ms Ramofoko (M Modisakeng) Mr Thage
8:00 – 8:25	Attendance registers	AO staff
8:30	Opening /Welcome and recap	Mr. E. Mogale/MC
8:40 – 10:15	Synopsis of results /Inputs from floor	Mudau/Matube/ Mokwele
10:15 – 10:30	HO2 break	
10:30 – 11:00	Maths, Science & Technology	Prof. Thapelo Mamiala (TUT)
11:00 – 11:15	ICT	Ms. R Molotsi UNISA (ex dep princ. @ Eletsa)
11:15 - 12:30	IPaD Show Case	iSCHOOLAfrica
12:30 – 12:45	Announcements/ activities after lunch	Dr. J Swanepoel/Mr Noval
12:45 – 13:45	*Light Lunch*	
13:45 - 14:45	Attendees chose to rotate between 6 venues for 30 min sessions each	
14:45 – 15:45	(Attend any two sessions)	
	Groups: Classroom 1 – Interactive tech support –	(Harties)
	Harties learners/teacher	Mr Noval
	Classroom 2 – ICT Task	N. Tshoma
	Classroom 3 – ICT Task team	N Tshoma
	Classroom 4 - Best practices the e-way	Mr Marobe
	Hall – Face book	Maggie Verster
	Classroom 6 (Engineer and Graphic Design)	

Madibeng AO

- the number one team in the province-

makes things possible through the impossible!

Appendix 10 The participants' biographical information

Participants	Schools	Subjects	Level of ICT experience
A	A	Accounting	Did not have any ICT related qualification
B	A	Physical science	Received Computer application as a course
C	B	Mathematics and Physical science	Computer course
D	B	Mathematics and Physical science	Received ICT skills at a University
E	C	Life Orientation	Honours Degree in Multimedia
F	C	Mathematics	Bachelor of Technology in Information Technology
G	D	Mathematics	Bachelor of Science in Information Technology
H	D	CAT and Business Economics	Advanced Diploma in Information Technology

Appendix 11: Semi-structured interview data coding

Question	Description	Inter-viewee	Code	Themes
How long have you used ICTs in teaching and learning?	Seven years	TA	Seven	The participants' ICT experience in teaching and learning
	Since 2003, when I was still teaching at (*the name of the school*). We had the computer laboratory there.	TB	Since 2003	
	Eh…..since 2010.	TC	Since 2010	
	For a while	TD		
	One year	TE	One year	
	I've been using it since 2006.	TF	Since 2006	
	Since 2008.	TG	Since 2008.	
	Around I would say three years now.	TH	Three years	
What ICT infrastruct	Computer lab, there are some computers functional and each	TA	Computer lab,	The available

ure does your school have?	head of department has a laptop.		computers and laptop.	ICT infra-structure in the selected secondary schools
	We've got a computer laboratory fitted with old computers, but some of them are still working around thirty at the moment, and we've got three data projectors. The mine also assisted us with the connectivity. They have given us a router, but we must buy, actually we have bought a simcard and the data bundles we have to buy them ourselves.	TB	Computer laboratory, computers, three data projectors and internet.	
	Okay, we've got …, of course it was stolen, but we had two laptops one for Maths and one for Science. So we're using, we use one for Maths – a laptop. Then we've got a projector for Mathematics	TC	Laptop and projector.	
	For infrastructure we have access to laptops, We have access to projectors, we have access to the inter-active whiteboard, we have access to, yes basically that's it.	TD	Laptops, projectors, interactive white board and internet.	

	We have two laptops for Maths and three computer laboratories.	TE	Two laptops, three computer and laboratories.	
	We have got three labs. One data projector for the main lab? Projectors, and there are three, printers. And photocopying machines. We have two laptops dedicated for Maths and Science.	TF	Photocopying machine, data projectors, two laptops and three printers.	
	Here they have computers, projectors, and even in the library they use barcodes for our system where they would be giving learners textbooks and when learners return those textbooks. Photocopiers and scanners. They have internet, teachers have access to it. It is only restricted to learners you know learners. Two computer labs. Both they are using	TG	Computers, Projectors, Internet two computer labs and internet.	

	it for CAT learning.			
	We've got here at the office the usual set-up, small network work-place. It is a small work-place network. And two computer labs in total. Four printers in the computer labs and we have around three offices here in the school each office has its own printer and around two more printers in the reception hall.	TH	Two computer labs and four printers.	
How did your school implement ICTs in teaching and learning	We do not have a direct policy because it depends on the ability of the teacher to use that technology, so normally advanced people who can use the tools use them. The computer lab computers have been donated by *(the name of a mine).* At the beginning there was a program to teach all teachers how to use computers. You see….. The coordinator was (*Mr X*). There were teachers who were supplied by the mine that would come in the afternoon and would go for	TA	No direct policy. There was a program.	The implementa-tion of ICTs in teaching and learning.

	computer lessons.			
	We are still behind. The mine has again assisted us, because there was a program where they visit our school and they taught our grade twelve learners basic computer skills and teachers were also trained and received the certificates.	TB	The mine assisted with a program.	
	Okay, basically, we had a donation from Epoc about sixteen computers to be used by learners, and three laptops to be used by teachers, but we also had a donation from Dinaledi. They donated thirty computers to be used by learners, including a whiteboard, a server. We were also given some Maths programs too. Like for me, I'm from Maths. We were given some Maths programs, some software, so that learners will be able to use, and also the teachers able to use. So we use those ones, maybe to draw things like graphs.	TC	Some Maths programs and software.	
	Like my school, what they did, we	TD	Use	

	use to do manual everything. Manual, manual reports, manual, manual everything but ever since 2008 I think when I came here, 2008 end of year, I think it was the first year when they started saying that we must start using the computer to make reports.		computers to make reports.	
	We started using computers when the school introduced CAT.	TE	When the school introduced CAT.	
	There are lessons for computers. Three teachers facilitate lessons. With lower grades they are focusing on computer literacy. And with higher grades they are teaching CAT.	TF	Lessons for computers, lower grades computer literacy and higher grades CAT.	
	With me when I came everything was in place.	TG	Do not know	
	That's unfortunately I do not even know how they started. But with me I	TH	Do not know	

	generally do is that everything I have learnt so far in computers-wise is what I have been teaching the kids but they do CAT so that is the basic fundamentals of computing in high school level or primary if you will. So they do Computer Technology, I mean Computer Application Technology. So that is as far as they are into the ICT context.			
How often do you install software in your computer?	Once in a while, as long as it's functional everything goes smoothly.	TA	Once in a while.	The installation of software in computers.
	Our problem is the financial position of the school. As I said we have to buy data bundles ourselves. So we rely entirely on the mine and (*name of a company).* The *(name of a company)* is a private company that was contracted by our school to try and service the school in terms of ICT.	TB	The company service the school in terms of ICT.	
	Usually we go to Dinaledi workshops, once a year, at least once a year, or twice. So whenever we go to Dinaledi, they give us updated software. When	TC	Done by Dinaledi people once a	

	we are back at school we install it in the computers.		year or twice a year.	
	We try to upgrade it, as much as possible. Like the one, the computers from Dinaledi, they came with their own software. But, of course with the use of the internet, when I'm using it I notice I can upgrade the software. I can also do the upgrade and all that, but it's not like it is prescribed by the school that upgrade must be done now and things like that. So, so you the person using the computer you have to be responsible for it, if you must upgrade the antivirus, you must upgrade.	TD	The person using the computer have to be respons-ible for it.	
	Once in a while it is easy you follow the wizard.	TE	Once in a while.	
	Me as a, as a Maths teacher, we just install the programs that we want, for example, on the laptops we just have to install the GeoGebra that we were supplied with. That's the only software that we installed on the laptops.	TF	Install the GeoGebra.	

	Like the virus updates, they are normally done, they normally have someone who can come, they normally update the systems. They download it maybe from the internet, and then they have the antivirus, something like that.	TG	Have someone who can come, they normally update the systems.	
	Our software installations are basically depending on how it is really needed. But then again, updates are installed on a weekly basis. Anti-virus updates and software updates on weekly basis.	TH	On weekly basis.	
Do you think ICT have much to offer in teaching and learning	Yes, just look at our kids, many of them don't know how to switch a computer on.	TA	Yes to kids, many of them don't know how to switch a computer on.	The benefits of ICT usage.
	For starters a teacher must be a friend to Excel, because you have to calculate learners' marks, you have to make some conversions. But if you are aware of the facilities within that Excel program it	TB	Our kids understand better	

	becomes easy. It will lessen teachers' administrative work and our learners, our kids understand better when they see things and when technology is used.			
	Absolutely, because if you see the learners of today, they are, no, they need much technologically advice. Learners need things which are you know, which are involving computers and some …, so it makes them love the subject more. Like I notice when we are teaching maths on the computer, ah, everyone loves that lesson, you know. So at the end of the day, they will understand better than the ordinary way of teaching.	TC	Absolutely, learners need much technologically advice	
	It has a lot and the reason why I became interested in trying to, to, to use ICT we went for a workshop it was organised by the University of xxxx. And then they were also, it was also on ICT trying to explain how we can get it off.	TD	It has, a lot.	
	Yes, ICT make lessons easier for	TE	Yes, makes	

	learners.		lessons easier for learners.	
	Yes, cause there's no way we can run away from the, this new technology, so the only way to go is to use it in the teaching and learning, but we have got some disadvantages that we met first at the early stages, but I'm sure as long as we continue using them, we will be able to go over the disadvantages which are associated and the use of it.	TF	Yes, there's no way we can run away from the, this new technology	
	Yes very, very much. Like, I think at this school if this school have money they will invent to store maybe, allowing maybe teachers to be able to use maybe the internet in their teaching, maybe installing those, allowing maybe teachers to be having access to the internet in their classrooms, so that they can connect to the internet, using the projectors.	TG	Yes very, very much.	
	Yes, it does. Unfortunately we live in an information age and we live in	TH	Yes it does,	

	an information age. You cannot go anywhere without computers. You just cannot. Everyone needs to learn at least to a certain degree how to use a computer. More especially teachers, they being pressurised to go digital nowadays so hard copies do not really work as efficiently as they did back then. So you need to know how to email, you need to know how to type. Not just typing, but then again after you type something, you need to make it look professional.		everyone needs to learn at least to a certain degree how to use a computer.	
Do your colleagues use ICT in teaching and learning	Some. Currently all educators…we've got the laptop department so you know in order to type anything we take the laptop from there. Head of department do whatever they do but there are some teachers who are not interested in using computers	TA	Some.	Some teachers enter marks and others surf the internet.
	It is a group, because in most instances we have to even, you know capture their marks. They would rather use pen and paper and write their marks there and the	TB	It is a group	

	HOD's would take the mark sheets and generate the mark sheets on Excel for them, you know I'm talking about the simplest.			
	Yes, like she's teaching tourism. She's using a laptop for, for learning, in the projector. Yes, but of course, not all of them, but some are, are doing it. But yes, just a few, I can say it's just a few.	TC	Some are doing it	
	No, some, just a few, and then for some the use of the ICT is just limited, they use it for some things not for teaching.	TD	No, some, just a few	
	Sometimes, they only use it when they are expected to enter marks, not for teaching and learning.	TE	When they are expected to enter marks	
	Other than the CAT staff. Okay, if you want to express out of the whole school out of ten, I'll say two.	TF	The CAT staff.	
	Yes they do. Like I can give an example of my colleague who is	TG	Yes they do.	

	teaching Accounting. I, we are normally together, mostly on the internet at the library, he said he is surfing the internet.			
	Most of them, yes They got the laptops but they do not have the means to facilitate learning	TH	They do not have the means to facilitate learning	

Appendix 12: The use of social networking tools by the participants

	Twitter	**Face book**	**Mixit**	**Chat**	**WhatsApp**	**Blogs**	**Wikis**	**Mailing list**	**Thutong portal**
TA	No	No	No	No	No	No	No	No	Tried it could not get through
TB	No	No	No	No	Communicate with learners	No	No	No	We use it frequently like searching for question papers
TC	No	No	Yes for More Math	With More Math	No	No	No	No	No
TD	No	No	No	Yes More Math program	No	No	No	No	Yes download questions from item bank to get support material
TE	No	No	No	No	No	No	No	No	Yes when using old curriculum

	Twitter	**Face book**	**Mixit**	**Chat**	**WhatsApp**	**Blogs**	**Wikis**	**Mailing list**	**Thutong portal**
									as source of information
TF	No	No	No	No	Yes with Maths teachers	No	No	No	No
TG	No	No	No	No	No	No	No	No	No
TH	No	No	No	No	No	No	No	No	Never use it

Appendix 13: Teacher D's lesson plan template

2013 LIFE SCIENCES GR 10 CLASSROOM MANAGEMENT - LESSON PLAN:

STRAND:

Life at the molecular, cellular and tissue level ✓	Life processes in plants and animals	Environmental Studies	Diversity, Change & Continuity

TOPIC: Mitosis

PRIOR KNOWLEDGE: Organelles, Cell structure

DURATION: 1 hour

DATE: 14/03/2013

Aims of NCS						
Problem solving through critical an creative thinking 	Individual and Teamwork 	Organise & manage effectively 	Collect, analyse, organise and critically evaluate information 	Communicate effectively 	Use Science & Technology effectively; responsibility towards the environment 	Demonstrate an understanding of the world 
✓					✓	✓

LEARNING OUTCOMES	LO 1 Scientific Inquiry and Problem Solving Skills	LO 2 Construction and Application of Life Sciences Knowledge	LO 3 Life Sciences, Technology, Environment and Society
Assessment Standards	1. Identify and questions phenomena and plan an investigation. 2. Conducts investigation by collecting and manipulating data. 3. Analyse, synthesis, evaluate data and communicate findings	1. Access Knowledge 2. Interpret and make meaning of knowledge in Life Sciences 3. Show an understanding of the application of Life Sciences knowledge in everyday life.	1. Explore and evaluate scientific ideas of past and present cultures. 2. Compare and evaluate the use and development of resources and products, and their impact on the environment and society. 3. Compare the influence of different beliefs, attitudes and value on scientific knowledge.

DATE	ACTIVITY	DURATION	LO 1	LO 2	LO 3
13/3/13	Cell cycle - Introduction to mitosis	1 hour			
14/3/13	Mitosis and cytokinesis	11			

EDUCATOR'S ACTIONS	LEARNER ACTIVITIES	RESOURCES & SUPPORT MATERIALS
Monitor	Brainstorm	Clinics
Facilitates	Follows instructions	Charts
Sets Questions	Observation / view	Pamphlets
Defining terms	Present info / communicate data	Playing field
Form groups	Write report	Newspapers
Questions & Answers	Demonstrate	Textbook
Demonstrate	Measure	Interviews
Explain	Discusses	Library
Support	Generate & questions hypotheses	Microscope
Notes	Evaluate	Magazines
Experiential Learning	Display	Nursery
Observation	Calculates	Zoo
Contextualization	Set up experiment	Visit University
Prepare workstations	Conduct experiment	TV
Provide resources	Compare	Educational Software
	Research	Industry
ASSESSMENT FOR LEARNING	Record results/finding	Wetland
Sharing learning goals	Summarise	Case study
Strategic Questioning:	Manipulate data	Local people
- Wait time	Interview	Community
- No hands up	Note making	Town council
- Talking Partners	Tabulate	Video
Effective feedback	Draws / plot	Specialist
- Traffic light	Identify & question phenomena	Picture/Photo
- Thumbs	Collect data	OHP
Self assessment	Analyse data	Textbook
Peer assessment	Link with career	Poster
	Entrepreneurial skills	Radio
	Plans investigation	Hospital
	Design tests/ surveys	Gauteng-Online
	Consider implications	Internet
	Identify advantages & limitations	Transparency
	Explain	CAPS Document
	Access information	Data projector
	Exercises	Bio viewers
	Works co-operatively	Fresh specimens
	Select	Fixed specimen
	Reaches/draw conclusion	Talk by someone
	Interpret data	

DAILY ASSESSMENT
Diagram
Calculation
Graph
Structured Essay
Practical experiment
Worksheet
Assignment
Model
Class test
Examination
Standardised test
Song
Role-play
Oral presentation
Written report
Poster
Team work
Interview
Questionnaire
Individual Practical
Table of data
Group Investigation
Drawing & Scaling
Group Practical
Newspaper/-letter
Case Studies

TYPES	METHOD
Baseline	Self
Diagnostic	Peer
Formative	Group
Summative	Teacher

TOOLS
Rating Scales
Observation Sheets
Checklists
Rubrics
Memoranda
Other

HOMEWORK

Activity sheet 3.1

LTSM REFERENCES

Powerpoint presentation on the Cell cycle.

EXPANDED OPPORTUNITIES

Cell division in prokaryotes

SPECIAL NEEDS

ENRICHMENT

PROGRAMME OF ASSESSMENT

Practicals		Research Project	Control Tests		June Exam	End Year Exam	
1	2	1	1	2	1	1	1

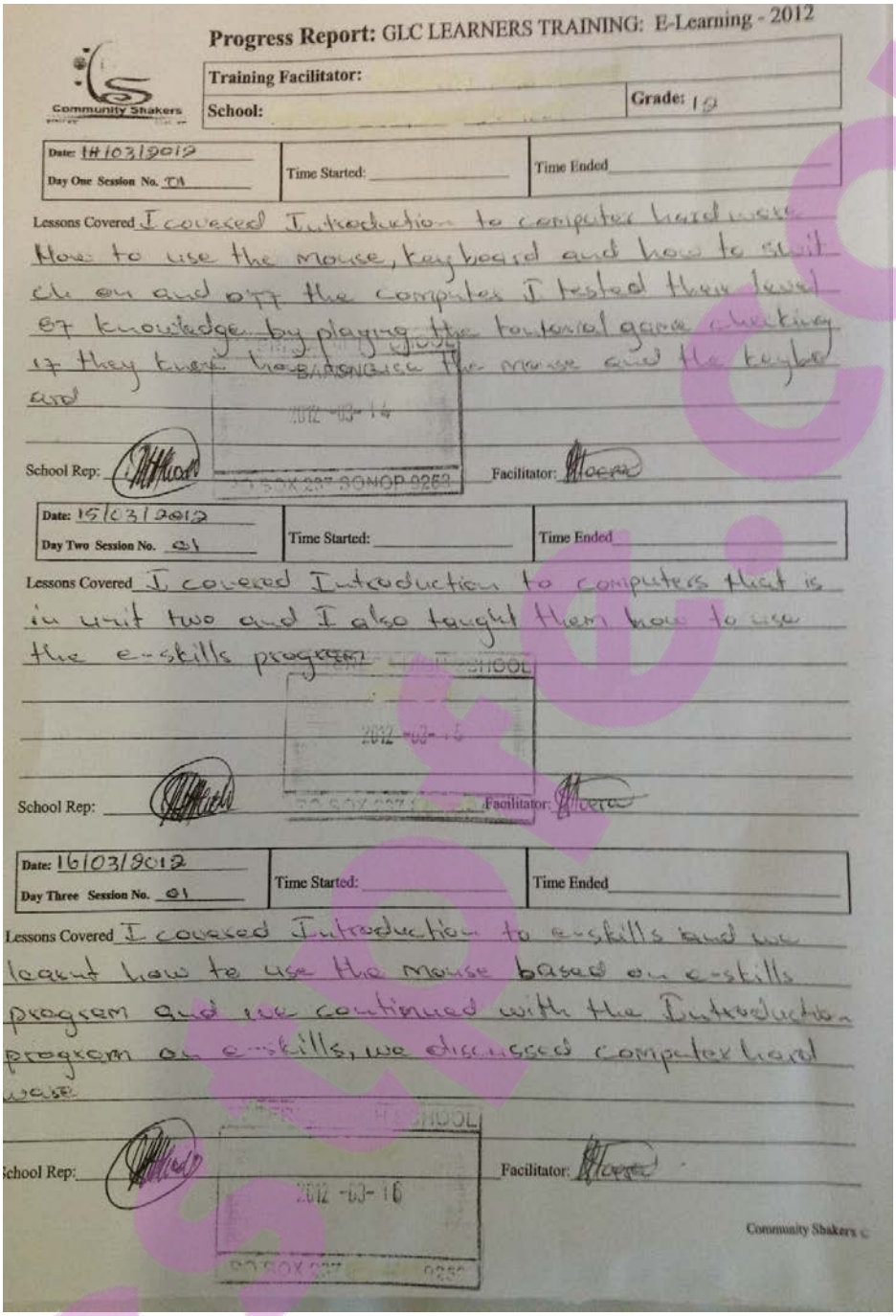
√ - **Tick in appropriate blocks**

REFLECTION: _____

_____

_____

Appendix 14: The grade twelve learner's ICT training progress report



Progress Report: GLC LEARNERS TRAINING: E-Learning - 2012

Community Shakers

Training Facilitator:

School: Grade: 12

Date: 14/03/2012 Day One Session No. 01 Time Started: Time Ended

Lessons Covered I covered Introduction to computer hardware. How to use the mouse, keyboard and how to switch on and off the computer I tested their level of knowledge by playing the tutorial game checking if they knew how to use the mouse and the keyboard and

School Rep: Facilitator:

Date: 15/03/2012 Day Two Session No. 01 Time Started: Time Ended

Lessons Covered I covered Introduction to computers that is in unit two and I also taught them how to use the e-skills program

School Rep: Facilitator:

Date: 16/03/2012 Day Three Session No. 01 Time Started: Time Ended

Lessons Covered I covered Introduction to e-skills and we learnt how to use the mouse based on e-skills program and we continued with the Introduction program on e-skills, we discussed computer hardware

School Rep: Facilitator:

Community Shakers ©

Appendix 15

An example of a recorded response of the semi-structured interview session

NAME OF AUDIO	:	VOICE 008.1
LENGTH OF AUDIO	:	37:40
TRANSCRIPTION LEGEND	:	RESEARCHER R
	:	INTERVIEWEE I

R Remember, everything that we are going to discuss here is confidential; no one will be able recognise which is your response.

R For how long have you been using technology in your teaching and learning?

I I have been using technology in my teaching and learning since 2003 while teaching at *(the name of the school)*; we had a computer laboratory there.

R Yes, I remember the school. Do they include CAT in their subjects as part of their curriculum?

I I am unsure if they include CAT in their subjects at the moment.

R How so?

I At the time, CAT was not a part of their school curriculum. The Africa Drive Project was introduced and its aim was to teach educators how to use computers in the classrooms.

R Okay, what ICT infrastructure does this school have?

I The school's computer laboratory consists of approximately thirty old computers and most of them are still in working condition.

R Why are there only thirty computers in the computer lab?

I I don't know why but the computer laboratory was designed to accommodate sixty-four computers.

R Who facilitated in the building of this computer laboratory?

I The school had the necessary space available to build a computer laboratory, while one of the mines in the area assisted in the fitment of the furniture and computers after the building had been completed.

R In other words, the mine assisted you with the ICT infrastructure?

I Yes, we also received three data projectors.

R Three data projectors

I Yes and the mine gave us a router for connectivity but the school is responsible for buying the sim card and data bundles.

R Now, if you could just share with us how your school implemented ICTs into teaching and learning?

I The mine visited our school and taught our grade twelve learners basic computer skills, but we are still behind regarding the implementation of ICTs.

R Did you allow them to teach the grade twelve learners basic computer skills? The reason for my question is that some people would insinuate that the learners' teaching and learning time would be wasted. Surely teaching computer skills would be more beneficial starting with grade ten learners and then progressing to the higher grades?

I Yes, we merged the computer lessons with Life Orientation classes. Therefore, of the four hours allotted to Life Orientation per week, at least two of those hours per month were allocated to computer skills.

R So, you divided the Life Orientation periods into two for computer training and two for Life Orientation?

I Yes, but this did not occur every week, only two hours a month were allocated to computer training.

R Oh it is two hours in a month?

I Yes

R How often do you install software into these computers?

I Not often as the school struggles financially buying our own data bundles. We rely entirely on the mine's support and Community Shakers. The Community Shakers is a private company contracted by our school to maintain the school in terms of ICT implementation.

R Did the Community Shakers assist in training the teachers and explain how to integrate computers in their teaching and learning?

I Yes, they trained teachers and some teachers received the certificates. Then we realised that only the teachers were benefitting from the training; therefore, the decision to train learners was implemented.

R Okay, so they began by training the teachers?

I Yes

R Was the training effective?

I Yes, most teachers received certificates but they found certain aspects of the training difficult, for example learning how to save a document.

R Once the teachers' training had been completed, did they begin training the learners?

I Yes

R Alright, do you think the learners were benefitting from the training?

I Yes, the learners seemed to be benefitting from the training. I took a few video clips during the training because we had to give feedback as to the effectiveness of the training and the learners' responses - and they thanked the people for the training.

R Was the computer training in line with the learners' school curriculum?

I No, the aim of the training was to teach learners basic computer skills such as how to put on a computer, open a file, save a document, browse the internet for research purposes if they do not have access to books.

R Okay, what training do you have that enables you to use these computers?

I I did a course on computer applications which I completed through the university while I was doing ECF as a course.

R Come again, Computer applications, at which university?

I (*the name of the University*)

R So when you did this ACE, in which subject did you specialise?

I Physical Sciences

R ACE Physical Sciences

I Yes

R Was there a computer training module?

I Yes, there were computer training modules and students had to write practical tests.

R Could you please elaborate more on these practical tests?

I They would identify institutions with computer laboratories in the surrounding areas so that students may write their practical tests. Your practical test is an electronic exercise which involves answering questions about Excel, timetables and formulae. Once you have given the formulae, you send it back.

R Did the University send a person to invigilate you?

I Not really

R What did the university do?

I If they chose a computer laboratory in Brits for example, as one of the examination centres, they would make arrangements with the people working there to invigilate the test.

R Did all the examination sessions consist of practical work?

I Yes

R So, they did not choose a school with a computer laboratory?

I No, unfortunately the university could not help us with connectivity. We needed a laboratory with more than twenty computers which are connected to the internet so that when you sit down and write the university can mark your answers and communicate with you live over the internet.

R Did many teachers attend the ACE Physical Science course?

I Yes, many teachers in this area attended that course.

R What additional support do you require in order to progress with this technology?

I We actually need new computers in the computer laboratory and the most important thing needed is connectivity. If we could get a satellite

dish like at *(the name of a school)*, it would give us connectivity. There were fourteen computers in that laboratory and they were all connected to the internet. During a simulation, each learner would be seated at a computer or a number of learners would be grouped together in pairs sharing a computer. The learners would be able to easily simulate what you are doing on your screen. It was still difficult for some learners back then because they struggled to use technology.

R Did they struggle to use technology?

I Yes, but what I do now instead of taking them to the computer laboratory, I ask them to take out their cell phones and Google, which is also not a good thing because we discourage the use of cell phones in the classroom because they use their cell phones to listen to music.

R Do you think technology has much to offer for teaching and learning?

I Yes

R Can you elaborate a bit more on the topic?

I A teacher must be experienced in Excel, because they have to calculate learners' marks and make some conversions. If you understand the facilities within that Excel program it becomes easier to use. It will lessen teachers' administrative work and our learners will understand better when they see things and when technology is used. I struggle with fractions in Physical Sciences, but I'm trying to work on it. There is a project that Tukkies is working on.

R What is the name of this project?

I It is called TRAC.

R Okay, could you elaborate more?

I This year we are giving grade tens a practical investigation or an experiment on the states of matter, how it will affect the states of matter. Traditionally we need the thermometers, Bunsen burners and we heat ice as we take the readings. What happens now, we will heat the ice, but the probes are computerised, so the computer would take the reading from time to time. The learners could take the readings each time and the computer would assist them in generating graphs. The computer would give them more accurate graphs, although we do encourage them to do it on their own too without the help of computers. So at least they have the skill and when they see it on a computer it becomes easier.

R Is this project still being implemented?

I Yes

R Do they supply you with software?

I No, they do not supply the software. The facilitator, (*xxxxxx*) would come to the school and we would discuss topics that we are busy with; then he works through the practical in the laboratory with the learners.

R Are you present?

I Yes I am present. Earlier you mentioned the importance of ICT, and if somebody was to ask a group of learners to draw a picture of heaven, you would get many different pictures. Now, we know having talked about the same thing, but we see and understand things differently.

R Okay, so how do you explain abstract concepts in a way that each learner understands?

I When you try to teach these learners abstract concepts, it is sometimes best to use simulations because it focuses the attention or mental picture of all the learners.

R Okay, do your colleagues use ICT in their teaching and learning?

I Some of my colleagues would rather write their learners' marks using pen and paper and then the HOD's would take their mark sheets and generate the marks onto Excel for them.

R So they use Excel purely for administration purposes and not even for teaching and learning?

I Yes

R Is there anything to add in terms of teaching and learning?

I I'm not sure what to say but sometimes they would use the video tapes which we received from (*xxxxxxx*) for Mathematics and Science. When teachers are absent we play the tapes for the learners on the data projector.

R It is used by people who are computer literate and not the subject teacher?

I Some of them are computer literate, I would say for every five teachers, two would be computer literate.

R One of the applications I have with me is word processing. If we had to reflect on your teaching and learning experiences, how would you implement this application in your teaching and learning?

I We type question papers and notes for the learners and in that sense we are introducing our grade twelve learners to computers and how to use this technology. We also take them to the computer laboratory and ask them to write letters then type it out and save them.

R What about the English teacher? When you mention typing letters, are they exercises for their English subject or do to they just practice typing letters to familiarise themselves with computers.

I To improve their skills

R What about their skills?

I As I mentioned previously we use some Life Orientation periods; therefore, Life Orientation is integrated into the computer training. We had a printer which was donated by (*xxxxxxxx*) but during the burglary it was stolen. We would print the exercises for Life Orientation and file them to say this is what the learner has done.

R Do you use Microsoft Office PowerPoint often for graphic presentations?

I Yes, we use the PowerPoint presentations quite often. We also use them for the (*xxxxxx*), normally we have the event at our school. We would collect pictures of educators and learners and project them there. The learners are required to generate the slides in an attempt to teach them more skills.

R Are learners able to generate slides?

I Yes, we have some learners who can generate slides, but unfortunately not all of them are able to do so. At the moment, some learners have been given the opportunity to create a school magazine on Microsoft office. The learners take pictures and export them to Excel, organising everything on their own with a little help from us.

R How often do they write this magazine?

I Our first bulletin was supposed to be out by December last year but up to now they have not yet been given a chance to because the printer was stolen and we also need a colour printer so that we start with the sample, we can take it for duplication.

R Okay, how did you choose the learners to do this magazine?

I I'm teaching them Physical Science and Mathematics but there are learners who can express themselves creatively and they came to me with ideas after which we realised they have the potential to put a magazine together.

R Please elaborate on their potential?

I Some learners are more creative with technology, realising that every time they are in the computer laboratory they assist others. If you ask them questions, they know almost everything.

R Okay, do these learners also assist the teachers?

I Sometimes when you try to set up a presentation, they will help prepare the presentation. They would come to you and say, "Mr (*xxxxxxx)*, let's check, no no, go to this file, check this file it is saved here."

R Do you use Excel spreadsheets for teaching and learning?

I We use the spreadsheets to calculate the learners' marks.

R Okay, only for calculation of marks?

I Yes

R Do you take learners to a computer lab and instruct them to access spreadsheets then start with calculation of marks?

I The teachers would give learners their marks after marking hard copies on paper and then the teachers enter the marks, design the formula, drop down and the formula works out the marks.

R So it is admin work?

I Yes, I would rate myself two out of five, because some teachers wouldn't know how to do it but they would always ask every time when

you are about to give out reports. Some teachers would say they have captured the marks on the computer; the only thing would then be how to put in the formula.

R Pardon me, how would you rate yourself, two out of?

I Two out of five

R Okay, and do you use the data base, Microsoft Office Access for teaching and learning?

I Yes, we use it for admin purposes.

R Do you use Microsoft Outlook Office for emailing?

I Yes, most teachers have got personal email addresses, although they still need help accessing their emails. The problem is that the school must buy data bundles because you cannot email. It is easier communicating with parents via email.

R Okay so the school allows teachers to use email?

I Yes

R Okay, how do you use search engines on the internet for teaching and learning?

I No, I tried some of them but the one that I use more frequently is the PHET simulations, I would get the simulations to try and enhance the understanding of concepts.

R Do you only use the PHET simulations or do you use any other forms of social media networking like Twitter for teaching and learning?

I No

R Facebook

I I find it difficult sometimes to assist learners with Facebook.

R Okay, but at least you are trying different methods of communication?

I We try to communicate more frequently. The Learners communicate through Facebook and WhatsApp.

R What about Mxit?

I Mxit is quite a challenge for me.

R Okay, do you use these communication tools to chat with the learners about school work?

I Yes, we use WhatsApp. The learners will always tell me if they can't come to school, if they will be late for Saturday classes or if they don't understand a question or instruction.

R Do you have a group chat on WhatApp?

I Yes, we have a group on WhatsApp.

R Does the school have any blogs?

I No

R Do learners really contact you and ask you questions, only through WhatsApp?

I Yes, they do.

R Okay, what about Wikis? Are you aware of all these communication tools?

I I don't know what Wikis is.

R Do you have a mailing list? What about the Thutong portal?

I Yes, we use it quite frequently, we are busy right now searching for the question papers for tourism, because we have just introduced tourism as a new subject so we don't have previous years' question papers.

R Do you blog as a source of communication?

I No

R Could you please tell me more about how you use the Thutong portal - question papers and what else?

I Some time ago we had disciplinary problems and we needed a manual for disciplining learners. We found the code of conduct for learners in South African schools, a grading system which the offences fall under; grade one, grade two, grade three, grade four offences. It is a wonderful tool because it gives you an offence and some disciplinary measures. There are forms to be filled out by the learner and their parents.

R This is great.

I It will always give us the revisions. So when you say this application to run and find out what this is. The other one is Education 2025.

R Education 20/25

I I was just trying to download it to go through it.

R I would like to go back to disciplinary graded offences. Do you download the forms?

I Yes

R When you request the forms be filled in by the parents and learners, do they comply?

I Yes

R Do they agree to do it?

I Yes they do and we show them that it is a government document.

R Could you please elaborate on Education 2010, what does it entail?

I No it is Education 2025.

R 2025

I I'm not very sure because I still want to download it and get more information. But it talks about the vision for 2025 that came up to say that we know our learners would succeed to matric but they can't read, they can't express themselves and they are mathematically challenged. So what I've understood so far is that the manner in which these learners are writing is actually progressing towards that 2025 vision. [This is a reference to Schooling 2025, action plan for improving Basic Education in South Africa.]

R Okay, so the aim is for South African schools to reach this vision by 2025?

I Yes

R We are now at the end of our interview.

I Okay.

R Thank you so much for your contribution and your valued time.

I Okay.

R Thank you so much.

I You are welcome, Ma'am.

END OF RECORDING

Appendix 16: Declaration by language practitioner

Leonie Viljoen (Dr)
Language Practitioner

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Declaration

09 December 2014

To whom it may concern:

I have edited the dissertation by ABUENG RACHAEL MOLOTSI for the degree of Doctor of Education in Curriculum Studies at the University of South Africa.

Title of dissertation: *Secondary-school teachers' information communication technology competencies in classroom practices.*

L. Viljoen

Leonie Viljoen ID 4208130077089 Tax no. 1353971029 DoB 13 – 08 – 1942

Appendix 17 Turnitin Report