Teacher perceptions regarding training and their subsequent ability to integrate ICTs into marginalised rural schools: The ICT4RED Case Study

by

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ABSTRACT

It is well documented that Information and Communication Technologies (ICTs) play an important role in education and that their use is associated with improving student learning and adding value to the curriculum. However, despite the opportunities that ICTs offer, numerous schools in South Africa face various barriers that result in the limited use of ICTs in the classroom. Literature has highlighted the lack of integration as one of these barriers. Teachers focus on teaching *about* ICTs where the focus is on developing computer literacy or technical knowledge rather than allowing students to learn through or *with* ICTs.

This thesis aims to explore the concept of ICT integration in rural schools, where ICTs form an integral part of teaching and learning practices. It presents a number of theoretical considerations for ICT integration with a particular focus on teacher pedagogical beliefs and barriers to integration. Using interpretivism as the underlying philosophy and thematic analysis as the analysis tool, the author reflects on ICT integration in the ICT4RED project at Arthur Mfebe Senior Secondary School in the Eastern Cape Province. Furthermore, this thesis offers an in-depth understanding of integration barriers in rural marginalised schools. These barriers are presented in Thematic Maps as well as a framework which incorporates both theoretical considerations and themes that emerged from fieldwork.

KEYWORDS: ICT integration, generative use, teacher training, ICT4RED, ICT barriers

Declaration

I declare that the Dissertation/Thesis entitled, *Teacher perceptions regarding training and their subsequent ability to integrate ICTs into marginalised rural schools: the ICT4RED case study*, which I hereby submit for the degree, Master of Commerce at Rhodes University, is my own work. I also declare that this thesis/dissertation has not previously been submitted by me for a degree at this or any other tertiary institution and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Kanya Zonke Nkula

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Introduction and Project Overview

1.1 Introduction and Background

Over the past few several decades Information and Communication Technologies (ICTs) have become prevalent in societies and in schools, offering hope to developing countries. They are viewed as engines for growth and tools of empowerment (Nwagwu, 2006; United Nations Educational, Scientific and Cultural Organisation [UNESCO], 2008; Achimugu, et al., 2009). According to UNESCO (2008), ICTs provide people in developing countries with the opportunity to increase their own agency and add value to the economy. Their use in developing countries also has a direct positive impact on development. Research by Ngwenyama, et al. (2006) on the relationship between investments in education, healthcare, ICTs and the human development index in five West African nations confirmed this by highlighting that increased investments in ICTs, healthcare and education significantly increased development in those West African nations.

ICTs enable economic and social development. They encourage economic development by connecting businesses globally and creating opportunities for employment, whereas social development is attained through using ICTs to improve issues such as education, skills development, income, employment, literacy and health (NetTel, 2005; Ashraf, Swatman and Hanisch, 2008). Thus, Walsham and Sahay (2006) have asserted that Information and Communication Technologies (ICTs) are particularly relevant to developing countries.

Hence, it is no surprise that institutions such as the United Nations Educational Scientific and Cultural Organisation (UNESCO) and the World Bank support and sponsor increased investment in ICTs and education for developing countries (Ngwenyama et al., 2006; UNESCO, 2012). Over the years South Africa has seen an increase in investments in health, education and ICTs. These investments form part of the government's action plan to ensure development after the apartheid era (Evoh, 2007; Naicker, 2010). According to Naicker (2010), this increased funding on ICT projects in South Africa aims to bring computers to schools and this is mainly attributed to the belief that ICTs in education transform students into knowledgeable independent learners who will be able to enter and compete in the modern global workforce (Wilson-Strydom and Thomson, 2005; Madumere-Obike and Imgbi, 2012). The South African Department of Education (DoE) also advocates that the use of ICTs in the

classroom is arguably one of the most powerful means of supporting learners to achieve nationally-stated curriculum goals (DoE, 2006). Learning through ICTs deepens the students' understanding, requiring them to use higher-order thinking skills. Furthermore, ICT integration in the classroom is expected to prepare students for the 21st century, a century where students are required to produce new intellectual work and obtain skills that will add value to society (UNESCO, 2008: Martinovic and Zhang, 2012). ICTs provide learners with the opportunity to develop these skills and to communicate new knowledge (Demetriadis, et al., 2003; Wilson-Strydom and Thomson, 2005; UNESCO, 2008; Naicker, 2010; Martinovic and Zhang, 2012). Most importantly, ICTs are predicted to improve student achievement and teaching (UNESCO, 2008).

Cooke and Dawson (2012) suggested that, although ICTs have been available as educational tools since the 1980s, historically education and ICTs were considered as two separate concepts. As a result, many schools with access to ICTs focused on learning *about* ICTs rather than learning *with* or through ICTs (Wilson-Strydom and Thomson, 2005; Maholwana-Sotashe, 2007). Wilson-Strydom and Thomson (2005) referred to learning about ICTs as *implementation without integration*. This concept encapsulates schools that implement ICTs without integrating them, schools that focus on developing computer literacy or technical knowledge rather than allowing students to learn through or with ICTs (Wilson-Strydom and Thomson, 2005; DoE, 2006; Du Plessis and Webb, 2008). According to Hokanson and Hooper (2000), learning *about* ICTs (implementation without integration) results merely in the representational use of ICTs, where ICTs are used to represent information.

However, on the other hand learning *through* or *with* ICTs, also referred to as *implementation with integration*, describes the ideal classroom situation where ICTs are woven integrally into teaching and learning (Hew and Brush, 2007). *Implementation with integration* requires ICTs to be incorporated into the curriculum and across subjects (Wilson-Strydom and Thomson, 2005; Du Plessis and Webb, 2008). According to Hokanson and Hooper (2000), the integration of ICTs results in the generative use of ICTs. Generative use describes the manner in which ICTs will be used, it refers to ICTs being used to construct and generate knowledge, where ICTs are interwoven into the curriculum where students use ICTs to deepen their knowledge and develop problem-solving skills (Wilson-Strydom and Thomson, 2005; Ashraf et al., 2008; Du Plessis and Webb, 2008). Even though learning about computers is essential (as it provides basic skills on computer use) it is important to ensure that students learn more than how to use various applications. Students need to use ICTs to construct knowledge as this is relevant in

the 21st century job market (Wilson-Strydom and Thomson, 2005; Du Plessis and Webb, 2012).

ICT integration does however serve as a challenge in schools. There are various factors that limit integration of ICTs in the classroom, teacher training being one of them. The use of ICTs in the classroom requires teachers to be trained on how to integrate ICTs into the classroom. But traditional educational practices do not provide teachers with the necessary skills to do so (Ertmer, 2000; Hew and Brush, 2007; UNESCO, 2008; Eteokleous, 2008). Even though teachers may be able to use computers on a personal or individual basis, they often have inadequate experience and skills when it comes to using ICTs for teaching and learning purposes (Eteokleous, 2008).

Another essential factor to acknowledge is that many teachers, especially veteran teachers, in a country such as South Africa, grew up in environments with limited electronic technology (Eteokleous, 2008). Therefore, they find it difficult to adapt to working with ICTs. In South Africa, the integration of ICTs into the teaching and learning process has been identified as one of the three main challenges associated with ICT use and adoption in schools (DoE, 2006). The White paper on e-Education (DoE, 2006) highlights that South African primary and secondary schools focus on teaching computer literacy (basic computer principles and word processing skills). Limited integration into teaching and learning is evident (DoE, 2006; Naicker, 2010; Du Plessis and Webb, 2012). Hew and Brush (2007) and Eteokleous (2008) identified incomplete and inadequate training as the main factor contributing negatively towards integration. Incomplete and inadequate training produces teachers with limited computer skills and knowledge. Hence, it is no surprise that many teachers see themselves as insufficiently prepared to use ICTs in the classroom (DoE, 2006; Eteokleous, 2008; Koehler and Mishra, 2009). As a result of incomplete and inadequate training, teachers tend to use ICTs in a restricted traditional manner, as high tech chalkboards. Therefore, students are more likely to learn about ICTs rather than learning with or through ICTs (Hew and Brush, 2007; Eteokleous, 2008). It is for these reasons that governments in Sub Saharan Africa and other developing countries emphasise the importance of constant teacher training, mainly because successful ICT integration in the classroom depends on the teacher (UNESCO, 2008).

Decisions on whether to use ICTs in the classroom rests on the shoulders of teachers, hence, it is essential that adequate training and development is provided (Ertmer, 2005; Eteokleous, 2008). However, training is not the only factor that impacts on ICT integration in the classroom.

Eteokleous (2008) pointed towards teacher attitudes, also known as teaching philosophy, in addition to the teacher's ability to use ICTs. Ertmer (1999), in her two type model of barriers that hamper teacher ICT implementation efforts in the classroom, identified factors discussed by Eteokleous (2008). Ertmer (1999) categorized these factors into first-order (extrinsic) barriers and second-order (intrinsic) barriers. First-order barriers, according to Ertmer (1999), are challenges that are extrinsic to the teacher. These barriers are typically a result of resources that are missing or inadequately provided. Second-order barriers are defined as those that are intrinsic to the teacher. These barriers are often rooted in the teachers' beliefs about teaching and learning. Early models of training and of education assumed that when first-order barriers are eliminated, ICT integration would follow. Yet, second-order barriers also play an important role in ICT integration. Hence, Martinovic and Zhang (2012) have recommended training that not only provides teachers with the necessary skills but also challenges teacher beliefs (Ertmer, 2005; Eteokleous, 2008; Sang, et al., 2010; Donelly, McGarr, and O'Reilly, 2011; Du Plessis and Webb, 2012).

Koehler and Mishra (2009) also emphasised the importance of providing teachers with various types of training. The authors presented a framework that aims to encourage teachers to integrate ICTs in the classroom. By encouraging training that will equip teachers with the ability to bring together content knowledge, pedagogy skills and technology skills (Evoh, 2007; Hennessy, Harrison, and Wamakote, 2010). Teachers who are capable of understanding these knowledge bodies are most likely to integrate technology into the classroom as they are able to offer knowledge about the subject content, knowledge on different types of technology and pedagogical knowledge within a technological environment.

The Technology Pedagogy and Content Knowledge (TPACK) framework (Koehler and Mishra, 2009) encourages training to go beyond computer skills acquisition. It encourages training that focuses on computer curriculum-integration and focuses on encouraging teachers to integrate ICTs. According to Evoh (2007) and Hennessy, Harrison and Wamakote (2010), this will lead to well-trained and motivated teachers, which is essential for integrating ICTs in the classroom.

This thesis subsequently aims to explore the concept of ICT integration in marginalised South African schools, with a particular focus on teacher perceptions regarding ICT use in the classroom and training. As mentioned before teachers are important in ensuring ICT integration

in the classroom. Hence this thesis aims for an in-depth understanding of the teachers' perspective regarding the training they receive and their ability to integrate ICTs.

This Chapter provides the reader with the background information around the topic. It focuses on emphasising the importance of the research by highlighting the problem statement, the research context and the goals of the research. Thereafter, there is a brief overview of the research methodology, research strategy, data collection methods, sources of data and data treatment.

1.2 Problem Statement

Quality education has become a concern in South Africa. Almost 20 years after the apartheid era, South Africa has one of the highest budget spending on education in the world (20% of GDP). Yet, performance levels are lower than in many other countries in the region (News24, 2014). According to UNICEF (2013), findings reveal that the quality of teaching is poor in South Africa, thus leading to low performance. History is, however, not the only reason why South Africa's education system is in crisis.

In an attempt to enhance teaching and learning as well as to improve the quality of education, the South African government has increased investments in ICTs in education over the years. Their aim is to bring computers into education, mainly because ICT integration is believed to enhance teaching and learning in the classroom (Naicker, 2010; Ramorola, 2013). Additionally, the White Paper on e-Education (DoE, 2006) states that ICT use in the classroom is arguably one of the most powerful means of supporting learners to achieve nationally-stated curriculum goals (DoE, 2006).

However, integration (generative use) of ICTs is a complex and challenging process, especially for schools with limited previous experience in ICT use in teaching (Wilson-Strydom and Thomson, 2005). Furthermore, in South Africa, the integration of ICTs into teaching and learning has been identified as one of the three main challenges associated with ICT adoption in South African schools (DoE, 2006). Often schools focus on teaching basic computer principles and word processing skills instead of integrating ICTs into the teaching environment (DoE, 2006; Naicker, 2010). According to Bialobrzeska and Cohen (2005), integration is not a norm in South African schools, mainly because many teachers lack the skills required to integrate ICTs into teaching and learning activities. As a result, some teachers do not use ICTs in their teaching.

South Africa is moving towards the use of tablets in education. Initiatives such as TECH4RED (see Section 1.3), that aim to improve rural education through technology, are examples of this move (Botha, Herselman and Ford, 2014). Another example is the initiative by the Gauteng Department of Education (News24, 2014) which aims for all learners and teachers to be using tablets instead of the traditional textbooks. In order to ensure that these initiatives succeed and to ensure that ICTs are used in a transformative manner, where they will add value to the curriculum and advance student learning, it is important to conduct an in-depth study that will discuss and encourage ways to ensure 'implementation with integration' (generative use) in schools. The reality is that most teachers might revert to their traditional methods of teaching due to lack of skills as a result of inadequate training. Even though training is not the only factor to have an impact on ICT integration or ICT use in the classroom, it is one of the major factors (Hew and Brush, 2007; Eteokleous, 2008). There are other factors such as teacher attitudes and teaching philosophy (Ertmer, 1999; Eteokleous, 2008). However, the teacher's ability to use ICTs is an important factor in influencing ICT integration in schools.

Taking into consideration the large investments made in ICT projects in schools in order to improve the quality of education in South Africa, as well as the increased focus on paperless education, this thesis aims to explore the concept of integrating ICTs into education with a particular focus on teacher perceptions on ICT use and training. The ICT4RED project in Cofimvaba will be used as the case study for this thesis. The researcher will focus on the perceptions of the teachers regarding ICT training received and their subsequent ability to integrate ICTs into the classroom.

1.3 ICT for Rural Education (ICT4RED)

During initial research on this topic, the researcher was introduced to the ICT for Rural Education Development (ICT4RED) project which is a project that forms part of the larger TECH4RED (Technology for Rural Education Development) research initiative by the South African Department of Science and Technology (DST), the South African Department of Basic Education (DBE), the Eastern Cape Department of Education (ECDoE), and the South African Department of Rural Development and Land Reform (DRDLR) (Botha, Herselman and Ford, 2014). The ICT4RED project aims to support rural teachers in integrating ICTs, particularly tablets, into teaching practices with the purpose of addressing the challenge of quality education in rural areas.

The Council for Scientific and Industrial Research's (CSIR) Meraka Institute supports and implements this initiative. Cofimvaba in the Eastern Cape served as the pilot district where the initiative targeted 25 schools (Botha and Herselman, 2013). Arthur Mfebe Senior Secondary School served as the pilot school in the district. During the time of this study, Arthur Mfebe Senior Secondary School was the only school where the teachers had completed the TECH4RED training. In addition to having completed training, the teachers at the school had been using the tablets for over a year. Arthur Mfebe Senior Secondary School served as the main school where the researcher focused on understanding the perceptions of in-service teachers regarding the impact of teacher training received from the ICT4RED project and their ability to integrate ICTs into the classroom.

1.4 Goals of Research

The primary aim of this study was to get an in-depth understanding of the perceptions of in-service teachers involved in the ICT4RED project, regarding ICT training received and their subsequent ability to integrate ICTs into the classroom. This study also aims to highlight barriers that hinder ICT integration in the classroom. It further aims to identify ways to ensure that teachers integrate ICTs by exploring a framework that highlights important factors to consider in ICT integration.

In order to understand the perceptions of the in-service teachers regarding the impact of teacher training on their ability to integrate ICTs into the classroom, and in order to gather meaningful data, the researcher focused on understanding the following:

i. Teachers' perceptions regarding the usefulness and value of ICTs in schools and education;

ii. Teachers' perceptions and beliefs concerning ICT integration in the classroom; and

iii. The perceptions of in-service teachers regarding how ICT training encourages and motivates them to integrate ICTs into the classroom.

Furthermore, this study will also provide context-specific findings that will assist in understanding the challenges of teachers in rural areas. Most importantly, it will provide insight into ways to ensure effective ICT integration in marginalised schools by focusing on factors that influence integration, such as teacher training.

1.5 Research Questions

This thesis highlights issues around ICT integration into the classroom. It also highlights barriers that limit integration in marginalised rural schools, with a particular focus on teacher training. Using the ICT4RED project as the case study to address the problem of limited integration in schools, the following primary question needed to answered:

"How has the ICT4RED professional teacher training programme impacted on in-service teachers to support integration of ICTs into the classroom?"

Answering this question highlights the impact of the training received by the teachers in the ICT4RED project. The research explores the kind of training offered to the teachers to ensure ICT use in the classroom and this question also encourages teachers to reflect on previous training received and to determine whether this training equipped them with the technology skills as well as the pedagogical skills required to integrate ICTs.

To address the various facets of the main question the following sub-questions are investigated:

"What are the teachers' perceptions regarding the usefulness and value of ICTs in schools and education?"

The purpose of this question is to determine whether teachers understand the usefulness and value of ICTs. Answering this question will determine whether teachers are willing to integrate ICTs into their classrooms or not. It provides insight into the teachers' beliefs and opinions on ICTs and education. Furthermore, it highlights the teachers' understanding of the benefit and usefulness of ICT use in the classroom.

"How do teacher perceptions and beliefs concerning ICT integration in the classroom affect their decision to integrate ICTs?"

The purpose of this question is to highlight the impact of teachers' pedagogical beliefs in determining whether teachers will integrate ICTs or not. The question explores the notion that teachers with a constructivist, student-centred pedagogical belief are most likely to integrate ICTs. Answering this question will provide information on how to ensure that teachers have the correct pedagogical beliefs that will result in ICT integration.

"What are the perceptions of in-service teachers regarding ICT training: has it encouraged and motivated them to integrate ICTs into the classroom?"

Training has been identified as a major factor that results in teachers not integrating ICTs or using ICTs in a representational manner. The purpose of this question is to determine whether training alone has the ability to motivate teachers to integrate ICTs. Additionally, it helps to determine those aspects of training that motivate teachers and the type of training preferred by teachers.

1.6 Research Methodology

The underlying orientation to knowledge used by the researcher is interpretivism. Interpretivism assists the researchers to understand human thought and action in social and organisational contexts (Walsham, 1995b, in Klein and Myers, 1999). It attempts to understand phenomena through the meanings that people assign to them and has the potential to produce deep insights into the world of lived experiences from the point of view of those who live in it (Nandhakumar and Jones, 1997; Schwandt, 1994 cited in Andrade, 2009). In this case an interpretivist approach was deemed appropriate. It provides the researcher with an in-depth understanding of the perceptions of in-service teachers as well as of the context.

The researcher initially adapted the approach of deductive reasoning (where the researcher goes into the community for data collection with a conceptual framework obtained from literature). The conceptual framework was used as a lens to provide the researcher with information to conclude and confirm premise (Burney, 2008). Deductive reasoning is an appropriate approach as it allows the researcher to apply general theory obtained from literature to a specific context and observe the particular phenomena. Thereafter, in addition to deductive reasoning, the researcher applied inductive reasoning in order to provide a richer understanding of literature and the context. Inductive reasoning assists researchers in understanding human thought and action in the social context as it draws general principles and theories from a particular case (Rubin and Babbie, 2001). This reasoning approach is aligned to interpretivism.

1.7 Research Strategy

Considering that the primary objective of this research is to understand teachers' perceptions regarding ICT training received and their ability to integrate ICTs in the classroom, the researcher chose a case study strategy. According to Creswell, Hanson, Plano and Morales (2007), case study research is a qualitative approach, which allows the researcher to explore a case or cases over time through detailed in-depth data collection. A case study research strategy aims to produce a comprehensive understanding of how participants relate and interact with

each other in a specific situation and how they make meaning of the phenomenon under study (Brouwer, Brekelmans and Niewenhuis, 2012). Furthermore, the case study strategy allows the researcher to observe how teachers interact with ICTs and how they use them to teach. The ICT4RED project in Cofimvaba serves as the case study for this particular research.

1.8 Data Collection

As mentioned in section 1.6, the underlying philosophy for this study is interpretivism, which aims to understand human thought and action in social and organisational contexts (Walsham, 1995b, in Klein and Myers, 1999). Data for this research has been gathered using semi-structured interviews and participation observation (Merriam, 2002). The use of participation observation in addition to interviews provides the researcher with the opportunity to secure data within the mediums, symbols and experiential worlds of the informants, which have meaning to the informants (Vidich, 1995). Furthermore, participation observation places the researcher closer to the context and social change. It provides the researcher with deep insights on the teaching conditions as well as the teachers' work environment, thus allowing the researcher to gain a deeper understanding of the interviewees and the context. The researcher also conducted semi-structured interviews. These interviews allowed for the recording of human experience in the field (Merriam, 2002). The interview questions were directed towards the participants' experiences and feelings about training. These questions were formulated in such a way that the interviewees were able to express their perspectives (Foddy, 2001). Semi-structured interviews were the main source of data collection. Participation observation was used as a secondary means of data collection. The use of both of these sources of data collection is a means of triangulation allowed the researcher to strengthen the data through cross validation (Kaplan and Maxwell, 2005; Myers, 2009).

1.9 Sources of Data

The ICT4RED project served as the case study. Arthur Mfebe Senior Secondary School was selected as the school where the researcher conducted interviews and observed lessons where teachers used tablets.

1.10 Data Treatment

The researcher used two sources of data, namely semi-structured interviews and participation observation. In each interview the responses were recorded, allowing the researcher to listen to

the interviews and align the answers to the questions from different interviewees. The data was also analysed using thematic analysis.

Thematic analysis is a data treatment method that focuses on identifying, analysing and reporting on themes or patterns found within the data (Braun and Clarke, 2006; Fereday and Muir-Cochrane, 2006). It requires the researcher to search for and identify common threads that extend across an interview or a set of interviews. The researcher found thematic analysis appropriate mainly because of its ability to report on experiences, meanings and the reality of the participants (Braun and Clarke, 2006).

1.11 Ethical Considerations

Ethical clearance in research projects is compulsory because of the involvement of human subjects in research; no research can proceed without ethical approval (Davies and Dodd, 2002; Boynton, 2005). Full details about the proposed research were presented to the Information Systems Department for ethical clearance: this included any letters sent to participants, consent forms, questions and a protocol for the proposed research (Boynton, 2005). A pilot study was also conducted before the actual interviews. Each interview was recorded and analysed at a later stage. All communication and interaction was conducted with honesty, integrity and trust.

1.12 Dissertation Structure

This research is divided into eight Chapters. Each Chapter focuses on a different topic.

- **Chapter 1** introduces the area of research by providing the reader with a background study of the research area. The problem statement and research context are also discussed. Thereafter the researcher discusses the goals of the research, research questions, research methodology and the research strategy. Data collection methods, sources of data and data treatment are also outlined. Lastly, the Chapter also discusses ethical clearance issues.

- **Chapter 2** presents the roles and uses of information communication technologies (ICTs) in education. The Chapter begins by discussing the emergence of ICT use in the classroom. Thereafter the Chapter unpacks the term 'integration' using phases of integration presented in the UNESCO (2002) report as well as Toledo's (2005) Five-stage Model for computer technology integration. Thereafter the Chapter introduces integration according to Hokanson and Hooper's (2000) types of integration.

- **Chapter 3** highlights issues and concerns around the adoption, acceptance and implementation of ICTs in education. First-order barriers and second-order barriers to technology adoption and integration are mentioned. The author also discusses the Technological Pedagogical Content Knowledge (TPACK) framework, which focuses on the knowledge required by teachers for integration. In addition to the TPACK framework the researcher provides a conceptual framework based on literature.

- **Chapter 4** describes the research methodology adopted for conducting this research. The underlying philosophy, interpretivism, is presented. The Chapter also addresses issues such as research strategies, data collection methods, sources of data and data to be collected. The interview guide, interview questions and field procedures are provided. Furthermore the Chapter explains thematic analysis and how it will be used to analyse the responses of interviewees. Hermeneutic principles are also discussed as well as ethical clearance.

- **Chapter 5** is where the researcher introduces the ICT4RED project as the case study where data will be collected. The Chapter aims to provide the reader with an in-depth understanding of the ICT4RED project by describing various aspects of the project. The TECH4RED initiative is explained, as well as the involvement of CSIR. Contextual information on Cofimvaba is also provided.

- **Chapter 6** details the observations made by the researcher from the field visits. It will provide an analysis of the observations by presenting themes that emerged from both field visits. Furthermore, the Chapter aims to provide the reader with the steps taken to analyse the data using thematic analysis. It will also provide the reader with information concerning the interviewees. Most importantly this Chapter provides the reader with the thematic analysis results by elaborating on emergent themes from the data. At the end of the Chapter the researcher presents a final conceptual framework based on interviews, observations and literature.

- **Chapter 7** revisits the research questions as presented in Chapter 1 and illustrates how they have been answered. Thereafter the Chapter presents the conclusion of the research, and the recommendations for future work.

Chapter 2
ICTs and Education

2.1 Introduction

This Chapter discusses the importance of ICTs in education. It begins by discussing the emergence of ICT use in the classroom. Thereafter, the Chapter unpacks the term 'integration' using phases of integration presented in the UNESCO (2002) report as well as Toledo's (2005) Five-stage Model for computer technology integration. Furthermore, integration is discussed according to Hokanson and Hooper's (2000) types of integration, which are defined according to how ICTs are used in the classroom, namely representational use (associated with little or no integration) and generative use.

2.2 ICTs in Education

Over the past several decades Information and Communication Technologies (ICTs) have become increasingly prevalent in societies and in schools; while they are not a panacea for educational problems they have become an integral part of education. They are considered as important for fostering co-operative learning and encouraging autonomous learning amongst students (Wilson-Strydom and Thomson, 2005; Madumere-Obike and Imgbi, 2012). According to Pade, Mallinson and Sewry (2008), the term ICT is an umbrella term that includes communication devices or communication applications, such as old ICTs like radio and television, as well as new ICTs, such as cellular phones, computers, tablets, and so on. Over the years ICTs, specifically computers and tablets, have become prevalent in South African schools as they are believed to add value to the curriculum by encouraging students to move away from learning by memorisation of facts towards a process of knowledge creation (UNESCO, 2004; Naicker, 2010). According to Khan, Hasan, and Clement (2012), research findings over the past two decades have provided evidence as to the positive effects of using ICTs in education. The authors explain that ICTs have the ability to:

1. Support education in schools.
2. Provide non-formal education for children and adults out of school.
3. Support distance education of pre-service teachers and in-service teacher development.
4. Enhance school management.

However, most importantly, ICT adoption in education offers potential for high quality education. These potential advantages have led developing countries, such as South Africa, to adopt technologies in order to enhance teaching and learning, hence the increased use over the past years (Khan, et al., 2012; Madumere-Obike and Imgbi, 2012; Ramorola, 2013).

The South African Department of Education (DoE) highlighted the importance of ICT use in education in the White Paper on e-Education released in 2003. The White Paper specifically stated that all students should be computer literate by the year 2013. The main purpose of this goal was to ensure that all students would know how to use ICTs, and to improve equity after the apartheid system (DoE, 2006; Wilson-Strydom and Thomson, 2005; Hodgkinson-Williams, 2006). Even though the Department of Education is committed to the adoption of ICTs in education, there are still schools in South Africa that do not have access to ICTs due to barriers such as lack of resources and teacher skills. According to Ertmer (1999), these barriers vary from personal fears to technical and logistical issues, and they hinder ICT integration. Nonetheless, ICTs in education and in the classroom are important tools in transforming the education system (Watson and Watson, 2011).

The integration of ICTs into teaching and learning places ICTs at the centre of teaching and learning in the classroom. It requires students to be given activities that will allow them to acquire skills in a meaningful context. ICT integration requires ICTs to be used in a cross-curricular way and for students to use ICTs to learn. What is important is the combining of technology, teaching and learning to meet curriculum needs (Flanagan and Jacobsen, 2003; UNESCO, 2004; Ramorola, 2013). According to Ramorola (2013), in the normal classroom setting ICTs are used mainly for word processing or drill and practice exercises where the focus lies on learning about ICTs rather than allowing students to use the ICTs to learn. Many schools with access to ICTs tend to do this. They focus on implementing ICTs without integrating them into the curriculum. They use ICTs in a limited manner, where they encourage "learning about the computer" or acquiring technical skills (Ertmer, 1999; Mueller, et al., 2008; Goktas, Gedik and Baydas, 2012).

Wilson-Strydom and Thomson (2005) explained that most schools focus on learning about computers mainly because the concept of ICT use and integration emerged as a response to computer software packages in schools. Before this the focus lay on developing computer literacy or technical skills rather than using the ICTs to learn (UNESCO, 2004). Furthermore, teachers face challenges in integrating ICTs. According to Ertmer (1999) these challenges vary

from personal fears to technical and logistical issues. Hence, teachers focus on technical skills and teaching about computers rather than integrating them into the classroom. ICT integration in schools requires teachers to be trained on how to integrate ICTs into the classroom (UNESCO, 2008). However, teacher training tends to focus on ICT skills acquisition rather than technology integration strategies or assisting teachers to use ICTs in lesson preparation and using ICTs in the classroom (British Educational Communications and Technology Agency [Becta], 2004; Balanskat, Blamire and Kefala, 2006).

Another reason for the lack of integration, according to Wilson-Strydom and Thomson (2005), is the fact that the concept of integration is a complex and challenging process for schools, especially those with limited previous experience in ICT use to support teaching and learning. In South Africa, the integration of ICTs into teaching and learning has been identified as one of the three main challenges associated with ICT adoption. As a result, one finds that integration is not a norm in South African schools. ICTs are not integrated into the daily routine at schools but are set aside for special occasions or a set "computer" session (Flanagan and Jacobsen, 2003; DoE, 2004; Du Plessis and Webb, 2012; Ramorola, 2013). The following section therefore explores what is meant by the term 'integration' and how ICTs are used when they are integrated into the classroom.

2.3 Defining Integration

According to Smaldino, Lowther, and Russell (2008), ICT integration does not simply refer to the placing of ICTs in the classroom, nor does it refer to the use of technology to support traditional teaching methods. Integration is the bringing together of technologies (ICTs) with teaching and learning strategies in order to meet curriculum standards and learning outcomes. It is the interweaving of ICTs into teaching and learning (Smeets, 2005; Hew and Brush, 2007; Ramorola, 2013). ICT integration places ICTs at the centre of teaching and learning in the classroom. It encourages students to develop thinking skills while learning *with* or *through* ICTs.

Literature identifies various definitions that describe the integration of ICTs. Wilson-Strydom and Thomson (2005) suggested that integration can be categorised in two ways. The first relates to the stages of integration and the second relates to the type of integration which is generally associated with the use of ICTs. The following section explores integration according to the stages of integration.

2.4 Stages of Integration

Several models and frameworks relating to stages of integration are discussed in the literature. These frameworks and models refer to the different stages that schools, colleges and departments of education experience as they move from lower levels of ICT use and integration to higher levels of ICT use and integration (Toledo, 2005). The stage of ICT adoption will determine the level of integration at schools, colleges or departments of education. The UNESCO (2002) report provided a four-stage continuum that discusses the stages which an educational system typically goes through when adopting ICTs. The framework is made up of four stages for ICT integration, namely the emerging, applying, infusing and transforming stages.

The Emerging Stage: This stage describes schools that are at their beginning stages of ICT adoption, where they are purchasing ICTs or have them donated to the school. At this initial phase, teachers and administrators are still exploring the idea of adding ICTs to the curriculum. This stage is still dominated by teacher-centred traditional teaching methods rather than student-centred learning. No integration is evident.

The Applying Stage: ICTs at this stage are used by administrators and teachers to complete their personal work and administrative work. Teachers at this stage begin to understand the importance of ICT use and they experience the advantages of using ICTs. They use ICTs in a manner to enrich the curriculum.

The Infusing Stage: Infusing involves embedding or integrating ICTs across curricula. At this stage the school focuses on using a variety of ICTs in classrooms, laboratories and offices. This stage demonstrates signs of integration.

The Transforming Stage: This phase involves the seamless integration of ICTs into daily personal and professional practice. ICTs are not only taught as a subject but they are also incorporated into all vocational areas. Furthermore, teaching moves away from traditional teacher-centred towards student-centred teaching (UNESCO, 2002; Wilson-Strydom and Thomson, 2005). This stage shows evidence of high levels of ICT integration as it places ICTs at the centre of education.

Toledo (2005) has presented a similar Five-stage Model for computer technology integration: pre-integration, transition, development, expansion and systems wide integration are the stages here.

Pre-integration: Similar to the "Emerging" stage presented by UNESCO (2002), teachers and faculty members in this stage show limited computer use on a professional and personal level. There is a lack of support to provide funding, resources and support and thus no signs of integration.

Transition: The transition stage is where teachers and administrators show an increased interest in ICT use and integration. This stage is similar to the "Applying Stage". The focus at this stage also lies on increasing integration and procuring funds and additional technical support. Levels of integration at this stage are low.

Development: Similar to the "Infusing" stage presented in the UNESCO four-stage continuum, this stage involves integrating ICTs across curricula. Schools at this stage begin to infuse technology throughout the curriculum.

Expansion: This stage focuses on encouraging teachers to take risks with teaching using new technologies and methods. The focus here is on fostering relationships between support personnel and the faculty members. According to Toledo (2005), these relations have an impact on the level of ICT use and integration. Expansion stage shows low levels of integration.

Systems Wide Integration: At this stage, ICTs are embedded into every subject. This stage is where teachers and students are enthusiastically involved in the infusion process. Similar to the transforming stage presented in the UNESCO (2002) report, this involves the seamless integration of ICTs into daily personal and professional practice. ICTs are taught as a subject and incorporated into all vocational areas.

The stages discussed above highlight the level to which ICTs are integrated or not integrated and the position of the teacher. They highlight the interdependent relationship between integration and the stage of adoption in schools. It is no surprise that the beginning stages of adoption generally mean low levels of ICT integration. Even though the Transforming Stage or the Systems Wide Integration stage are the ideal stages in which schools should operate, one finds that it takes time to get to these stages.

As part of the stages discussed by Toledo (2005), the author introduces the importance of leadership as well as the importance of relationship building between support staff and faculty members as this will affect integration. In addition to the stages of ICT adoption and

integration, it is essential to explore the term integration and to differentiate between the different types of integration. The next section will link the different stages of ICT adoption to the types of ICT integration as discussed in the literature.

2.5 Types of ICT Integration

According to Hokanson and Hooper (2000), types of integration are mainly defined by how ICTs are used in the classroom. The authors differentiate between two types of uses related to integration: representational ICT use and generative ICT use.

Representational use refers to the use of ICTs to transmit information. It involves learning about computers and the mastery of computer skills rather than using ICTs to create knowledge (Hokanson and Hooper, 2000; Hodgkinson-Williams, 2006). Representational use requires students to absorb information given by the teacher and focuses on learning about the computer (Hokanson and Hooper, 2000; Hodgkinson-Williams, 2006). It can be associated with the Applying and Emerging stage as per the UNESCO (2002) report, as well as the Pre-integration and Transition stage defined by Toledo (2005). Even though representational use is essential in developing technical skills, ICTs should not be limited to representational use only. This is because the use of ICTs in a representational manner does not require the engagement across or within the curriculum and for this reason Hodgkinson-Williams (2006) claimed that representational use cannot be seen as true integration.

Representational use incorporates ICTs in a limited manner; here ICTs are used to represent information, not to create or generate knowledge (Hokanson and Hooper, 2000). For example, allowing students to type an essay and making the front cover using font sizes and page border, would be described as representational use. This kind of use limits the impact of ICTs because there are other skills that students could acquire from ICT use. Representational use is associated with a teacher-centred pedagogical belief, which will be discussed in depth in Chapter 3 (Wilson-Strydom, et al., 2005).

Generative use, on the other hand, encourages knowledge construction by allowing students to design and create their own representation of knowledge through ICT use (Du Plessis and Webb, 2009). Loveless, De Vooged and Bohlin (2001) explained that knowledge construction requires more than being able to use the latest software or having ICT techniques. It requires students to be able to answer questions by being able to access, interpret, amend, analyse, construct and communicate meaning from the information gathered through ICT use. In order

to do this, ICTs need to be interwoven into the curriculum. They need to be seamlessly integrated into the daily work of students and not limited to a subject taught every week (Hokanson and Hooper, 2000; UNESCO, 2004; Wilson-Strydom and Thomson, 2005; Maholwana-Sotashe, 2007; Du Plessis and Webb, 2008). Generative use is associated with the Transforming stage in the UNESCO (2002) continuum, as well as the Development and Extension phase of Toledo (2005).

Generative use focuses on using computers to learn, rather than representational use, which focuses on how to use the computer. Even though learning about computers (representational use) is essential, it is important to ensure that students learn more than how to use various applications. This is mainly because the 21st century job market requires them to be able to construct and communicate new knowledge and, most importantly, they need to add value to society using ICTs. Generative use is associated with teachers who have a student-centred pedagogical belief (Ertmer, 1999; Hokanson and Hooper, 2000; Wilson-Strydom and Thomson, 2005; UNESCO, 2008).

Furthermore, to illustrate the different types of ICT use, Hodgkinson-Williams (2006) and Du Plessis (2010) cited in Du Plessis and Webb (2012), stated that in South Africa the following ICT uses are dominant:

1. Learning about ICTs, which focuses on equipping the students with computer literacy skills. It involves using computer applications without a link with what is happening in the classroom (Du Plessis and Webb, 2012). This type of integration can be associated with the Emerging stage when referring to the UNESCO (2002) four-stage continuum. The main focus lies on teaching how to use the computer and it is teacher-centred.

2. Implementation with integration to achieve traditional goals refers to the use of computers as tutors or transmitters of knowledge. This refers to using computers to carry out drill and practice exercises. It is slightly linked to generative use as it encourages students to learn from the computer and it encourages integration with a small link to what is happening in the classroom. However, it still does not allow students to learn independently by using ICTs to create their own knowledge. Thus, there is no evidence of full integration: representational use is still evident.

Moreover, the authors explained that generative use, which they term as Implementation with full integration within a constructivist learning space, is not prevalent in South Africa.

Implementation with full integration within a constructivist learning space or context refers to learning *with* or *through* ICTs, where ICTs are used as learning tools and woven into the curriculum. This is where ICTs are used to encourage student-centred learning (Hokanson and Hooper, 2000; Du Plessis and Webb, 2012). This type of integration can be linked to the Transition stage when referring to the UNECO (2002) four-stage continuum.

Considering Africa, particularly South Africa, even though literature shows that the South African education system is transforming to accommodate ICT use in schools, many schools still focus on representational use, where the focus is on learning about ICTs, and where computers are being used as tutors or transmitters of knowledge (Hokanson and Hooper, 2000; Du Plessis and Webb, 2012; Ramorola, 2013). Bialobrzeska and Cohen (2005) identified teachers' lack of skills as one of the main reasons for the lack of ICT integration.

Unwin (2005) claimed that across Africa and in many developing countries teachers lack computer skills necessary for effectively integrating ICTs into learning. As a result, computers are set aside for use only on special occasions and they remain an object of curiosity, fear, uncertainty and mystery rather than an enabling tool (Pelgrum, 2001). Besides computer skills required by teachers to effectively integrate ICTs into teaching and learning, teacher beliefs can also play a critical role in the adoption and integration of ICTs in the classroom (Naicker, 2010; Song, Hannafin and Hill, 2007). Several studies theorise that teachers with constructivist beliefs are associated with high-level use of computers, whereas low computer use is associated with traditional beliefs (teacher-centred practices) (Ertmer, 2005; Naicker, 2010; Sang, et al., 2010). Furthermore, there are other barriers that limit integration, such as lack of resources. Ertmer (1999) categorised these barriers into two types, namely first-order (extrinsic to the teacher) and second-order (intrinsic to the teacher) barriers. The Chapter that follows will discuss these barriers in depth as well as their impact on the integration of ICTs in the classroom.

2.6 Conclusion

This Chapter has discussed the importance of ICTs in education as stated in the literature. It highlights the benefits of adopting and integrating ICTs into the classroom. This Chapter has also explored how integration can be defined by looking at phases of integration as well as the

uses of ICTs. Phases of integration provide the various stages that schools go through, highlighting the shift from limited integration to full ICT integration depending on the stage that a school is at (UNESCO, 2002; Toledo, 2005). Furthermore, the Chapter highlighted two types of ICT use, namely representational and generative, which can be associated with the various stages of integration. For example, schools at the Emerging Stage were most likely to use ICTs in a representational manner compared to schools at the Transforming Stage. The Chapter indicates that in South African schools, representational use (learning about computers) was more prevalent than generative use (implementation with full integration). The reason for this is mainly due to barriers that limit integration. These barriers will be discussed in the following Chapter.

Chapter 3
Barriers to ICT Integration

3.1 Introduction

Chapter 2 explored the role and value of ICTs in education. This Chapter will highlight issues and concerns around the adoption, acceptance and implementation of ICTs in education. First-order barriers and second-order barriers to technology adoption and integration are described. Also discussed is the Technological Pedagogical Content Knowledge (TPACK) framework, which focuses on the knowledge required by teachers for integration. TPACK is discussed in order to provide insight on the type of training teachers need. Second-order barriers are discussed again to highlight that there are other factors beyond training that influence integration. At the end of the Chapter the researcher will provide a conceptual framework based on the literature. This framework will highlight important factors that have an impact on integration as discussed in the literature.

3.2 Integration Barriers

Chapter 2 provided a discussion on the types of integration as well as the phases that schools go through when adopting ICTs. The Chapter established that in South African schools, generative use is not prevalent. Bialobrzeska and Cohen (2005) pointed towards teachers' lack of skills as the reason for the lack of ICT integration in the classroom. However, according to Pelgrum (2001) and Martinovic and Zhang (2012), in addition to teachers' skills, other barriers such as lack of resources as well as the traditional educational setting hamper ICT integration. Ertmer (1999) provided a model that categorises various barriers that hamper teacher ICT implementation efforts in the classroom. These barriers can be categorised into first-order barriers (i.e. extrinsic to the teacher) and second-order barriers (i.e. intrinsic to the teacher). Ertmer's (1999) model also encompasses factors that cause teachers to abandon integration. Building on earlier work by Ertmer (1999) on first- and second-order barriers, Hew and Brush (2007) provided an analysis of barriers documented over approximately eleven years (1995–2006). They identified six main categories of barriers limiting integration, four comprised of first-order barriers (i.e. resources, support, subject, institution) and two comprised of second-order barriers (i.e. teacher attitudes and beliefs, and teacher knowledge and skills). The authors described resources, teacher knowledge and skills, and teacher attitudes and beliefs as the three most frequently cited barriers impacting technology integration. Tsai and Chai (2012)

expanded on Ertmer's two-type model and proposed a third-order barrier, the lack of design thinking. There is limited literature describing third-order barriers for which further research is needed. The following section will elaborate on Ertmer's first-order barriers.

3.3 First-Order Barriers

First-order barriers typically refer to resources that are missing or inadequately provided. These barriers, according to Donnelly, McGarr and O'Reilly (2011), are easily removed when money is provided. Hence, these barriers are concentrated on initially. They include lack of technical support, lack of access to appropriate resources (software, hardware, and internet access), inadequate training and lack of time. Having to deal with first-order barriers may frustrate teachers and lead to them not integrating ICTs. It is for such reasons that it is important to focus on these barriers. The following section will briefly discuss first-order barriers as highlighted in the literature.

Lack of Resources

Lack of resources is one of the major barriers to integration. According to Khan, et al., (2012) the implementation of ICTs demands infrastructure such as a reliable electricity supply, as well as resources such as computers, printers, scanners, and projectors etc., which are generally not available in rural areas. The unavailability of these resources hampers integration. Ramorola (2013) provided an example where the lack of resources, namely computers, resulted in no integration. The author explained that lack of ICTs results in learners having to work in groups of six at one computer, making it difficult for teachers to integrate ICTs into the classroom; as a result, teachers resort to using textbooks (Wilson-Strydom and Thomson, 2005; Hew and Brush, 2007).

Lack of Access to Resources

Lack of access to resources is another barrier that is cited in the literature. Beyond the availability of resources, lack of access to the correct type and number of ICTs required by the teacher hinders integration (Ertmer, 2005; Hew and Brush, 2007; Khan, et al., 2012). Access to the correct type of resources and number of resources is essential in ensuring integration.

However, increased access to a resource such as ICTs does not necessarily mean that integration will be guaranteed. According to a study conducted by Wilson-Strydom and Thomson (2005) of teachers in the Intel Teach to the Future programme, increased access to

ICTs (correct type and number) does not lead to increased implementation of ICT integrated lessons. Wilson-Strydom and Thomson (2005) found that 58% of the teachers who implemented technology-related lessons at least once a month had between 11–20 computers, yet 33% of those who never integrated ICTs had more than 21 computers. Increased access to ICTs does not necessarily lead to increased integration of ICTs (Wilson-Strydom and Thomson, 2005). This goes to show that other factors influence integration, apart from the first-order barriers.

Lack of Technical Support

Lack of technical support is another barrier mentioned frequently. According to Ertmer, et al. (2012), there are different types of support that are needed to ensure effective integration. These include administrative, technological, professional and peer support. Teachers need these types of support to cope with different technologies and technical difficulties. Unfortunately schools lack this support and this hinders ICT integration.

Lack of Time

Khan, et al. (2012) identified lack of time as another major first-order barrier. They explained that teachers are burdened with work as they are also responsible for administrative tasks. Most teachers complain about the time required to prepare for using ICTs, and the introduction of ICTs adds to their workload. ICT integration requires teachers to search for information, review websites and design content, as well as set up classroom activities that require ICT integration, rather than using the traditional textbook (Hew and Brush, 2007; Ertmer, et al., (2012). Teachers simply do not have the time to do this, hence most of them resort to using textbooks (Khan, et al., 2012).

Lack of Professional Development

Lack of professional development or teacher training is another prevalent barrier (Ertmer, 2005; Evoh, 2007; Du Plessis and Webb, 2012). Teachers who lack ICT knowledge and skills do not use ICTs in their lessons. According to Odera (2011), training could serve as the first step in motivating these teachers to integrate ICTs as it teaches the necessary skills to use ICTs. Ertmer (1999) emphasised that teachers need access to multiple types of training where technological and pedagogical needs are addressed, mainly because the teachers' ability to use ICTs affects their willingness to integrate them into the classroom. If teachers do not have the

knowledge and skills to use ICTs they will not integrate them (Ertmer, 2005; Eteokleous, 2008).

Inadequate training produces teachers with limited ICT skills who lack confidence in teaching with computers. As a result of this, computers are often set aside at schools for special occasions and they remain objects of fear and curiosity (Albion, 1999; Hew and Brush, 2007; Eteokleous, 2008). ICT integration requires teachers to be trained on how to integrate ICTs into the classroom, as traditional educational practices no longer provide teachers with all the necessary skills to do so (UNESCO, 2008). Even though teachers may be able to use computers on a personal or individual basis, they often have inadequate experience and skills when it comes to using ICTs for teaching and learning purposes. Furthermore, it is essential to acknowledge that many teachers, especially older teachers in countries such as South Africa, grew up in environments with limited electronic technology and find it difficult to adapt to working with ICTs. Hence, it is no surprise that some teachers see themselves as insufficiently prepared to use ICTs in the classroom and they often see no relevance or value of using ICTs in teaching and learning (DoE, 2006; Eteokleous, 2008; Koehler and Mishra, 2009).

Teacher training tends to focus on ICT skills acquisition rather than technology integration strategies or assisting teachers to use ICTs in lesson preparation and in the classroom (Becta, 2003; Balanskat, Blamire and Kefalas, 2006). Furthermore, traditional educational practices do not provide teachers with all the necessary skills to integrate ICTs into the classroom, hence Ertmer (1999) emphasised that teachers need access to multiple types of training where technological and pedagogical needs are addressed. The TPACK framework presented by Koehler and Mishra (2009) is an example of a framework that underlines the skills/knowledge required by teachers in order to integrate ICTs into the classroom. It provides insight on how traditional teacher education can be changed in order to ensure ICT integration in the classroom.

3.4 Second-Order Barriers

As discussed above, the level of ICT skills possessed by teachers is a factor in the integration of ICTs. However, the level of ICT skill is not the only factor that is influential in ICT integration. In addition to first-order barriers Ertmer (1999) also identified second-order barriers; these barriers are defined as intrinsic to the teacher. Du Plessis and Webb (2012) described second-order barriers as being rooted in the teachers' beliefs about teaching and learning. These barriers are based on the teachers' pedagogy, personal preferences, attitude,

and philosophy about teaching and learning. Second-order barriers are identified as more difficult to overcome than first-order barriers, mainly because they are tacit and personal (Ertmer, 1999). The following section will discuss second-order barriers in depth.

The Role of Teacher Training in Addressing Second-Order Barriers

As mentioned in Chapter 2, inadequate teacher training is one of the main first-order barriers that hinders ICT integration. Inadequate teacher training produces teachers with limited ICT skills, and subsequently teachers who lack confidence in teaching with ICTs (Albion, 1999; Hew and Brush, 2007; Eteokleous, 2008).

It is for this reason that Davis, Preston and Sahin (2009) emphasised the importance of training that goes beyond simple computer skills such as word-processing. These authors claimed that training needs to provide support for teachers; it needs to equip them and to prepare them for ICT integration in the classroom. Furthermore, according to Teo (2009), training should not be conducted in the traditional manner. Training needs to be carried out in a constructivist manner, where teachers are able to experience success in computers and gain confidence in using computers. However, even though training might be provided, some teachers may still not integrate ICTs due to first-order barriers but others do not integrate ICTs because they do not feel confident enough to do so (a second-order barrier) (Ertmer, 1999; Hennessy, et al., 2010). Hence, it is essential to understand the importance of second-order barriers.

Teacher perceptions and attitudes are amongst the important second-order barriers that determine how teachers will use ICTs in the classroom (Ertmer, 2005; Evoh, 2007; Davis, et al., 2009; Naicker, 2010; Martinovic and Zhang, 2012). As discussed in Chapter 2, teachers may use ICTs in a representational (implementation with no integration) manner, which is more teacher-centred, or in a generative manner (implementation with integration), which is student-centred. Ertmer, et al. (2012) suggested that the best way to encourage teachers to implement and integrate ICTs is through increasing the knowledge and skills of the teachers, which in turn can change their attitudes and beliefs. Therefore, Sang, et al. (2010) encouraged training that challenges the teachers' beliefs regarding teaching and learning and addresses teacher perceptions and attitudes towards ICT use and integration in education (Naicker, 2010). The following second-order barriers were highlighted as important in literature:

Teacher Self-Efficacy

Teacher self-efficacy is an intrinsic factor that refers to the teachers' perceptions of their ability to teach (Hennessy, et al., 2010). Teachers with higher self-efficacy are often open to new ideas and willing to experiment in their classrooms as they seek to improve their teaching methods (Sang, et al., 2010). Teachers with high beliefs in their abilities to teach are, therefore, most likely to adopt, implement, and integrate ICTs in their classrooms. Teacher self-efficacy has an impact on the teachers' decision as to whether they will be open to integrating ICTs or not.

Teacher Attitudes

Teacher attitudes have been found to be a major predictor in determining whether teachers will integrate ICTs or not. Teachers with negative attitudes towards ICTs are less likely to accept and integrate ICTs, whereas teachers with a positive attitude towards ICTs require less effort and encouragement to learn new skills required to implement ICTs in their classroom designs (Huang and Liaw, 2005; Khan, et al., 2012). Teacher attitudes and beliefs are central to integration. A study conducted by Khine (2001) of 184 pre-service teachers clearly illustrated that there is a relationship between computer attitudes and use (Demetriadis, et al., 2003; Martinovic and Zhang, 2012). It is for this reason that authors have highlighted the importance of changing the teachers' attitudes.

Teacher attitudes are highly impacted by the teachers' previous experience and computer-efficacy, as well as ICT training (Hermans, et al., 2008). This, therefore, reinforces the importance of training as well as dealing with second-order barriers such as computer efficacy, illustrating the need for a framework such as TPACK that takes second-order barriers into consideration.

Teacher Computer-Efficacy

Teacher computer-efficacy refers to the teacher's own beliefs and perceptions of their capability to use computers (Sang, et al., 2010). Teachers with higher computer-efficacy tend to use computers more often and they experience less computer-related anxiety, whereas teachers with lower computer-efficacy tend to experience frustration and hesitate to use computers when they encounter problems (Sang, et al., 2010). Ropp (1999, cited in Sang, et al., 2010), stated that many teachers have a positive attitude towards ICT use in the classroom, but do not believe in their ability to use ICTs in the classroom. Training plays an important role in increasing teacher computer-efficacy because it provides the teachers with the knowledge

and skills to use ICTs (Ertmer, 2005; Eteokleous, 2008). Additionally, Fourie and Krauss (2011) claimed that even with positive attitudes teachers need time to master and practice skills.

Teacher Pedagogical Beliefs

Teacher beliefs about teaching and learning play a major role in determining whether the teacher will use technology in the classroom. According to Hermans, et al., (2008) and Liu (2011), each teacher enters the teaching setting with their personal theories about teaching and learning; they have their personal interpretation of the instructional situation and a set of beliefs that determine how students learn. They view and perceive teaching situations differently and, based on their beliefs, they make judgments and decisions on how to act, and which strategies to implement and materials to use (Hermans, et al., 2008; Chen, 2008; Liu, 2011). Teacher beliefs are the individuals' ideas about the best way teaching should occur and how students learn. According to Hermans, et al., (2008), these beliefs are influenced by factors such as the teachers' earlier experiences and their professional context, as well as the manner in which they were taught.

Chai, Hong and Teo, (2009) stated that teacher pedagogical beliefs are typically made of teacher-centred pedagogical beliefs or student-centred pedagogical beliefs. Teachers with teacher-centred pedagogical beliefs are most likely to use ICTs in a representational manner (no integration), whereas teachers with a student-centred pedagogical belief are most likely to integrate ICTs and use them in a generative manner (Ertmer, 2005; Naicker, 2010; Sang, et al., 2010). Thus, it is important to shift teacher beliefs from teacher-centred towards student-centred pedagogical beliefs due to the fact that constructivist practices are positively correlated with ICT use (Hermans, et al., 2008).

Teacher-Centred Pedagogical Beliefs (Instructivist Teaching Practices)

Teachers with a teacher-centred pedagogical belief are believed to have little interaction with their students mainly because they impart knowledge through a "chalk and talk" mode. These teachers apply an instructivist teaching practice, where they are the main transmitter of information and where the students are passive information receivers (Chen, 2008; Naicker, 2010; Liu, 2011). Teachers with this teaching belief focus on knowledge reproduction rather than knowledge creation (Pelgrum, 2001; Wilson-Strydom and Thomson, 2005; Chen, 2008; Baeten, et al., 2010; Naicker, 2010).

Educators with a teacher-centred pedagogical belief are likely to use ICTs in a representational manner (Hermans , et al., 2008), thus teacher-centred pedagogical beliefs are highly attributed with a negative correlation to ICT integration in the classroom. On the other hand, studies theorise that teachers with a student-centred pedagogical belief are associated with high-level use of computers (Ertmer, 2005; Naicker, 2010; Sang , et al., 2010).

Student-Centred Pedagogical Beliefs (Constructivist Teaching Practices)

Student-centred pedagogical beliefs (constructivist teaching practices) allow teachers to become facilitators within the classroom. Teachers with this belief apply a constructivist teaching practice where they encourage students to learn independently (Chen, 2008; Baeten , et al., 2010).

According to a study conducted by Lim and Chai (2008) on Singaporean teacher beliefs, teachers who held a constructivist pedagogical belief integrated ICTs into teaching and learning. These teachers integrated ICTs through activities such as asking the students to complete research projects using assigned websites and conducting group discussions using laptops (Liu, 2011). Furthermore, Chen (2008) emphasises that these teachers did not only encourage the students to have discussions, they also encouraged students to have multiple viewpoints and to be able to debate their own opinions, indicating that constructivism encourages learners to become active knowledge constructors rather than being passive learners (Pelgrum, 2001; Wilson-Strydom and Thomson, 2005; Chen, 2008; Baeten, et al., 2010; Naicker, 2010). Jonassen (1996, cited in Ramorola, 2013), stated that there are four principles of constructivist learning, namely: principle of knowledge construction, principle of active learning, principle of social interaction and co-operative learning and the principle of situated learning:

> **Principle of knowledge construction** is self-explanatory. It refers to students constructing their own knowledge using their own experiences and interactions. This principle highlights the fact that teaching is not about transmitting or imparting teacher knowledge on to the learner. It is about guiding learners to construct and to be able to represent what they have learnt.
>
> **Principle of active learning.** This principle states that students learn through activities, as illustrated by Lim and Chai (2008) in their example of Singaporean teachers' integration activities.

Principle of social interaction. According to Jonassen (1996, cited in Ramorola, 2013), for constructivist practices social interaction is essential. Learner-to-learner or learner-to-teacher interactions are vital in learning. Interaction with others assists students to determine their own identity while acknowledging that others are different from them.

Principle of situated learning refers to the implication that learning should occur in a real-life context, a context where the concept or the lesson is embedded. This principle encourages learning that occurs beyond the classroom.

According to Ramorola (2013), teachers with constructivist teaching practices and student-centred pedagogical beliefs display these principles in their everyday teaching in the activities they design. Hence it is important to provide training that encourages constructivism and the associated principles.

Without a doubt, teacher pedagogical beliefs about teaching and learning are highlighted as essential indicators in determining ICT use in the classroom. Hence, it is essential to get a full understanding of teacher beliefs in order to determine whether teachers will use ICTs in the classroom or not (Hermans, et al., 2008). However, even though teachers with student-centred pedagogical beliefs are often associated with high-level ICT use, Sandholtz and Reilly (2004) stated that there are inconsistencies between teacher pedagogical beliefs and practice. Some teachers with constructivist pedagogical beliefs use technology in an instructivist manner which is associated with teacher-centred pedagogical beliefs (Ertmer, et al., 2012; Sandholtz and Reilly, 2004). The following section will briefly discuss these inconsistencies.

Inconsistencies between Beliefs and Teaching

Despite the notion of constructivist (student-centred) pedagogical beliefs being positively associated to ICT integration, Liu (2011) claimed that teachers may still use technology in a teacher-centred instructivist manner. For example, they require students to learn about the computers or to perform drill and practice exercises that which are associated with representational use and instructivist (teacher-centred) pedagogical beliefs, rather than constructivist (student-centred) beliefs. Teachers with constructivist (student-centred) beliefs may not necessarily translate these beliefs into practice in the classroom (Ertmer, et al., 2001; Liu, 2011).

There are various reasons for these disparities in beliefs and practices. For instance, Li (2007) found that teachers resort to abandoning their constructivist practices in order to ensure a high exam score, especially if they are teaching an unfamiliar subject. Similarly, Chen (2008) conducted a study of Taiwanese teachers who did not integrate ICTs and identified teachers' limited understanding of constructivist practices and teachers' conflicting beliefs due to influence of external factors (parents) as other factors that cause inconsistencies in beliefs. The section below elaborates on these:

Limited understanding of constructivist practices: Chen (2008) explained that some teachers lack a theoretical understanding of integration and this is another reason that would explain the inconsistency between expressed beliefs and practices. In the study conducted by Chen (2008) with Taiwanese teachers, it was found that two of the twelve participants whose beliefs were constructivist (student-centred) admitted that they often did not know how to design technology-based learning activities. This led to them using ICTs in a teacher-centred manner. Moreover, many of the teachers considered constructivism ideal rather than practical. Therefore, it is important that training reflects strategies on how to integrate technology into the classroom instead of providing teachers with skills on operating the computer, so as to make training practical.

Conflicting beliefs: Chen (2008) explained that some teachers had conflicting beliefs about using technology and external factors reinforced these beliefs. Teachers expressed that content coverage plays a role in them choosing to abandon their beliefs. There is pressure for the teachers to cover content and they were unwilling to spend valuable time exploring new technologies. A science teacher interviewed by Chen (2008) mentioned that he did not want to skip content and use more time to conduct activities using technology, mainly because if students are unable to answer questions in their exams they will report this to their parents who will in turn complain to the headmaster. Similarly, when Li (2007) interviewed Canadian teachers it was found that teachers resorted to abandoning their constructivist ideas and technology use in order to ensure high exam scores, especially when teaching an unfamiliar subject.

Additionally, Liu (2011) also discussed constructivist teachers who did not practise constructivist activities. The author identified cultural context and pressure from parents as some of the factors that result in teachers abandoning their constructivist teaching ideas. Lack of access to computers, insufficient time to plan and the lack of technical support are other

reasons why teachers abandon constructivist practices. Chen (2008) emphasised that most teachers avoid uncertainty and would rather maintain order in their classroom, hence they resort to using traditional teacher-centred methods to help reduce uncertainty and anxiety. Ertmer, et al. (2012) claimed that the manner in which teachers deal with these factors differ: some have managed to overcome the external factors while others have opted to use blended pedagogical practices where they use traditional pedagogical and constructivist pedagogical beliefs. Taking into account second-order barriers such as teacher self-efficacy, teacher attitudes, teacher computer-efficacy and teacher pedagogical beliefs it is important to ensure that teachers are equipped with the skills and knowledge to build their confidence to integrate ICTs into the classroom. As mentioned many teachers have a positive attitude towards ICT use in the classroom, but do not believe in their ability to use ICTs in the classroom (Sang, et al., 2010). Thus, Ertmer (1999) emphasised that teachers need access to multiple types of training where technology and pedagogical needs are addressed, mainly because the teachers' ability to use ICTs affects their willingness to integrate them into the classroom. Koehler and Mishra (2009), provided an example of a framework that proposes the qualities of knowledge required by teachers for ICT integration in their teaching.

3.5 TPACK

3.6 Framework

As discussed before, teachers often lack experience with using ICTs as many earned their degrees at a time when ICTs were at a different stage of development. Hence, some do not see themselves as prepared or capable of using ICTs (Koehler and Mishra, 2008). The TPACK framework addresses this by discussing the knowledge required by teachers for ICT integration. According to Koehler and Mishra (2009), the TPACK framework puts emphasis on teacher knowledge mainly because they view teachers as the autonomous agent with the power to decide whether ICTs will be used in the classroom. The framework builds on Shulman's (1987) work that resulted in the idea that for effective ICT integration, teachers should have content and pedagogical knowledge. It argues that at the heart of good teaching is content, pedagogical and technology knowledge; the framework further highlights that training should provide the opportunity for teachers to develop these combinations of skills (Koehler and Mishra, 2009; Polly and Brantley-Dias, 2009).

The TPACK framework is presented in a Venn diagram (see Figure 3.1) with three core categories, namely Pedagogical Knowledge (PK), Technological Knowledge (TK) and Content

Knowledge (CK) (Graham, 2011). This framework focuses on the interaction between three bodies of knowledge: technology, pedagogy and content knowledge (TPACK). The framework emphasises that training should provide teachers with the opportunity to build these skills. **Technological Knowledge (TK)** refers to technological knowledge as knowledge about the different types of technology, ranging from low-tech to high-tech. It involves understanding various kinds of technology that the teacher can use. **Content Knowledge (CK)** refers to knowledge about the subject being taught. With CK, teachers are expected to know the content they are going to teach as this will allow them to choose the correct technology in order to achieve communicating the content to the students. **Pedagogical Knowledge (PK)** requires teachers to have deep knowledge about processes and teaching methods. They need to be able to understand how students learn and have classroom management skills. Additionally, they are required to be able to plan lessons and assess students.

These three core categories of knowledge overlap and result in four additional types of knowledge required by teachers for integration**. Technological Content Knowledge (TCK)** refers to knowledge on how technology can change learner practices and how learners understand concepts in a specific content area due to technology integration. It highlights that teachers need to understand how content and technology influence and constrain each other. TCK requires teachers to understand which technologies are best suited for addressing certain subjects (Koehler and Mishra, 2009). This means that teachers will make informed decisions about the technology they need to use based on the content they aim to present. **Technological Pedagogical Knowledge (TPK)** requires the teacher to understand how technology can change the way of teaching (pedagogy). It includes knowing the constraints and affordances that relate to certain ICTs and the disciplinary contexts within which they function (Koehler and Mishra, 2009; Graham, 2011). TPK knowledge requires the teacher to be open-minded and to seek ways to choose technology for the sake of student learning and understanding. TPK requires teachers to be creative in seeking technologies/ICTs mainly because conventional ICTs (e.g. MS Office) are not tailored for education. **Technological Pedagogical Content Knowledge (TPCK)** suggests that content, pedagogy and technology knowledge have a role to play separately and together (Koehler and Mishra, 2009). TPCK focuses on the interaction of these three main bodies of knowledge and emphasises the balancing of these three bodies in order to ensure effective teaching with ICTs.

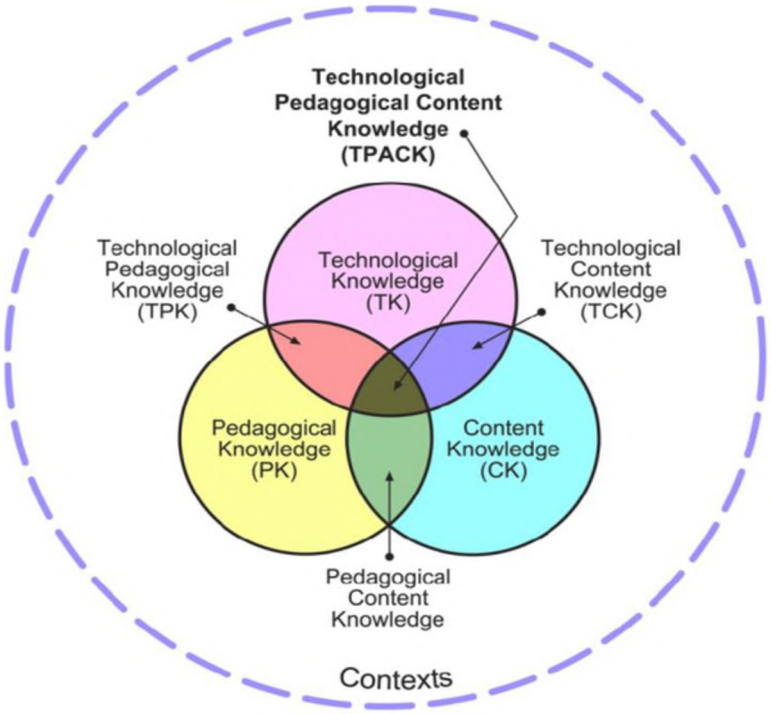

Figure 3.1 TPACK Framework (Koehler and Mishra, 2009)

The TPACK framework points towards the importance of providing teachers with technological skills and pedagogical skills to use the provided technology. This is because the teachers' ability to bring together content knowledge, pedagogy skills, and technology skills greatly affects ICT implementation and integration (Evoh, 2007; Hennessy, et al., 2010). As mentioned, Becta (2003) and Balanskat, et al. (2006) have emphasised the importance of providing teachers with pedagogical training mainly because teacher training tends to focus on ICT skills acquisition rather than technology integration strategies. Training needs to assist teachers to use ICTs in lesson preparation and in the classroom. The TPACK framework can be adopted in the training of teachers as it encourages training that provides practical examples on how technology can be used to conduct lessons.

However, literature mentions that the framework has several weaknesses. Firstly, Graham (2011) pointed out that TPACK lacks theoretical development, because it is built on Shulman's (1987) Pedagogical Content Knowledge (PCK) framework, an existing framework that lacks theoretical clarity. Secondly, the framework has a high degree of parsimony. It is over simplified and does not take into account factors beyond content, pedagogy and technology, such as teacher beliefs and context. Thirdly, the framework is made of different categories that

do not have precise definitions. According to Cox (2008, cited in Graham, 2011), there are 13 distinct definitions for TCK, 10 definitions for TPK, and 89 for TPACK.

TPACK can be viewed as a conceptual lens through which educational technology can be viewed. According to Koehler, Shin and Mishra (2012), the framework draws attention to specific technology and pedagogy issues and ignores irrelevant issues. However, the framework requires further work. Although it (TPACK) provides insight on the kind of skills that the teachers need to ensure integration, literature highlights the importance of looking at first and second-order barriers as well as context. TPACK encourages training that goes beyond simple computer skills such as word-processing. However, factors such as teacher beliefs and context are not discussed in the framework, even though they are relevant to educational technology. It is for this reason that the researcher added to the TPACK framework (see Chapter 6, Figure 6.7), in order to take into account teacher beliefs and context.

The TPACK framework does usefully state the impact of second-order barriers such as teacher beliefs. It does this by addressing pedagogy knowledge that needs to be attained by the teacher. It challenges teachers to move away from conventional teaching methods by providing the various types of knowledge teachers need in order to teach with ICTs (Koehler and Mishra, 2009). For the purpose of this research it is important to view TPACK as a framework that can be used to design the education required by teachers to integrate ICTs into the classroom. However, one needs to acknowledge that TPACK is limited as it does not mention all factors that influence the teacher's decision to integrate ICTs in the classroom.

The conceptual framework presented by the researcher in Chapter 7 enhances the TPACK framework and it highlights the importance of developing TPACK skills in order to ensure integration of ICTs into the classroom (Koehler and Mishra, 2009). However, it also focuses on the teachers' pedagogical beliefs and ensuring that these beliefs are aligned with ICT integration (Wilson-Strydom and Thomson, 2005; Goktas, et al., 2013). The conceptual framework accentuates the importance of addressing both first-order and second-order barriers such as training and building teacher self-efficacy. The framework puts emphasis on the fact that first and second-order barriers are inter-dependent, even though several researchers indicate that first-order barriers are easy to overcome and can be easily eliminated as they are highly dependent on financial resources. Merely dealing with first-order barriers is not enough to ensure integration (Wilson-Strydom and Thomson, 2005; Goktas, et al., 2013).

3.7 Conclusion

This Chapter highlighted issues and concerns around the adoption, acceptance and implementation of ICTs in education. It discussed Ertmer's (2005) first-order barriers, followed by a discussion on second-order barriers. Thereafter Koehler and Mishra's (2009) TPACK framework was presented. The author discussed the Technological Pedagogical Content Knowledge (TPACK) framework as a framework that can be used in training to account for the skills required by teachers to integrate ICTs into the classroom. However, due to the fact that TPACK is limited, the researcher presents a conceptual framework that builds on the TPACK framework which consists of additional concepts. According to the researcher, these concepts are essential as they inform the study, its research questions and problem statement. This framework is presented in Chapter 7 and it takes into account concepts such as first-order barriers and second-order barriers as factors that also influence ICT integration in the classroom.

Chapter 4
Research Methodology

4.1 Introduction

This Chapter describes the research methodology adopted for conducting this research. It will address issues such as research strategies, data collection methods, sources of data and data to be collected. The interview guide, interview questions and field procedures will also be provided. Furthermore, this Chapter will explain thematic analysis and how it will be used to analyse the responses of interviewees. Hermeneutic principles are also discussed, as well as ethical clearance.

4.2 Research Philosophy

The underlying philosophy used by the researcher is interpretivism. According to Klein and Myers (1999), interpretivism has emerged as an important strand in Information Systems research. Unlike positivism, interpretivism does not focus on declaring dependent and independent variables, but rather focuses on understanding human thought and action within context (organisational or social contexts). The interpretivist philosophy involves understanding social phenomena through the meanings that people assign to them (Klein and Myers, 1999). It assumes that knowledge is socially constructed and that the same human action can have different meaning to different people. The use of interpretivism allowed the researcher to interact with the research participants and to become the "vehicle" that reveals these differences in reality (Klein and Myers, 1999; Andrade, 2009).

Interpretivism as a philosophy takes the stance that methods for studying natural sciences are inadequate when studying social phenomena, mainly because people create their own meanings of the world. An interpretivist approach assisted the researcher in understanding the research context. It provided the researcher with the opportunity to interact with the research participants, who provided insight on their thoughts and actions. These interactions between the participants and a researcher not only provide the researcher with the opportunity to understand human thoughts and actions but they also provide the researcher with deep insights into the world of lived experience from the point of view of those who live in it (Lee, 1991; Nandhakumar and Jones, 1997; Schwandt, 1994 cited in Andrade, 2009).

Through interpretivism, a researcher can develop an understanding of the context from which a description of its characteristics and complexities can be created. Moreover, through this philosophy the researcher is also be able to gain insight into the research participants' experience, as interpretivism fundamentally focuses on the interpretation of other people's construction of what they are involved in. The researcher is also presented with the opportunity to reveal differences, if there are any, in the participants' thoughts, and provide insight into each participant's experience in his/her context (Geertz, 1973).

According to Klein and Myers (1999), within the interpretive philosophy hermeneutics forms a major branch. Similar to the interpretivist philosophy, hermeneutics focuses on uncovering meaning and bringing about understanding (Myers, 2009). Myers (2009) stated that hermeneutics can be treated as an underlying philosophy or analysis tool; for this research it will be treated as a secondary data analysis tool. In addition to thematic analysis, hermeneutics will be used to help the researcher interpret the meaning of data (Myers, 2009).

As mentioned before, the interpretivist philosophy focuses on understanding human thought and action within context through interacting with the participants, hence the researcher found this particular philosophy appropriate. Nandhakumar and Jones (1997) did, however, state that even though the interaction between researchers and participants does provide an understanding of the participants' interpretation, it may be limited in a number of ways. Firstly, researchers cannot rely on one participant's description as this may lead to misinterpretation. Some terms may mean something different to other participants. It is for this reason that the researcher plans on interviewing more than one participant. Secondly, participants may provide an account of their behaviour different to what actually happens. Thirdly, actors may be secretive and fear to discuss issues that are seen as sensitive. Lastly, participants may not be able to provide insight into their behaviour or actions, mainly because it has formed part of their routines.

It is for such reasons that Nandhakumar and Jones (1997) suggested the importance of reflecting on unarticulated understanding, as well as being observant of gestural and visual bodily responses of the participants (Goffman, 1998, in Nandhakumar and Jones, 1997). Hence, in this study the researcher was observant and took note of any unarticulated responses through employing participant observation as an additional data collection strategy.

4.3 Research Approach

Aiming to gain a deep understanding of the context and of the literature, the researcher made use of a combination of deductive and inductive reasoning (Schultze, 2000). The researcher initially adapted the approach of deductive reasoning, whereby the researcher went into the research context for data collection with a conceptual framework obtained from the literature (TPACK framework). Chapter 3 described the TPACK framework as well as concepts such as first-order and second-order barriers that the researcher used as a lens to collect information for concluding and confirming the premise (Burney, 2008). Chapter 6 provides the final conceptual framework which includes context specific information gathered through inductive reasoning. Burney (2008) described deductive reasoning as a top-down approach which assists in coming up with findings that will answer questions presented by the researcher. Schultze (2000) described deduction as reasoning that relies on the methodological application of objectified constructs, frameworks and theories, whereas inductive reasoning generates authentic localised events specific to the context. Similarly, Hayes, Heit and Swendsen (2010) explained that inductive reasoning allows the researcher to use existing information from observations and interviews to inform literature. This was done by the researcher to provide a richer understanding of the context, hence the development of the final conceptual framework in Chapter 6. Additionally, the combination of deduction and induction will assist in establishing whether there is a correlation between literature and themes observed from the research context. This will also ensure that the researcher provides rigour and relevant literature that encompasses context-specific information (Hayes, et al., 2010).

4.4 Research Strategies

An interpretive case study research was chosen as a strategy by the researcher. According to Oates (2006), case study research is a study of one instance of a case to be investigated within its real-life context. Case studies allow the researcher to get rich, in-depth information about the case that is being studied and the relationships and processes in the case it investigates (Myers, 1997; Oates, 2006). Furthermore, case study strategy aims to provide a holistic study, where the researcher learns more about the poorly understood or about change that has occurred over time. It aims to understand a case in its real-life context (Myers, 1997; Oates, 2006).

Considering that the primary objective of this research was to understand teachers' perceptions regarding ICT integration in the classroom and their ability to integrate ICTs in their classroom, the researcher chose a case study strategy, because the focus of the research was not simply

about getting teacher perceptions but also about understanding the context/natural setting of the teacher (Oates, 2006). In order to get information on the case to be studied, the researcher needs appropriate data collection methods, which will be discussed below.

4.5 Data Collection Method

Considering that this research focuses on understanding human thoughts, perceptions and actions (integrating ICTs) within context, it was essential for the researcher to interact with the participants. Moreover, when one considers the underlying interpretivist philosophy, interaction with the participants is encouraged (Nandhakumar and Jones, 1997), hence the researcher decided on semi-structured interviews as well as participation observation for data collection.

According to Tashakkori and Teddlie (2003), interviews are a major method for data collection, where the researcher establishes a rapport by asking the interviewee a series of questions based on the conceptual framework from the literature, i.e. the deductive aspect of the research. This researcher mainly used semi-structured interviews because they allow for the recording of human experience in the field (Merriam, 2002; Bless and Higson-Smith, 2000, cited in Krauss, 2007). Semi-structured interviews allow participants to express their experiences and views in their own terms and allow for a more conversational interview (Kaplan and Maxwell, 2005; Davies, 2007). Semi-structured interviews also contribute to the researcher's understanding of the social reality and give the researcher perspectives on the chosen subject (Davies, 2007). The questions in this research's interviews were open-ended and non-leading. These questions were formulated in such a way that the interviewees were able to express their perspectives and speak freely (Foddy, 2001). The interview questions are considered as a point of departure for discussion.

Participation observation was used as a second means of data collection, where the researcher observed the use and integration of ICTs in the classroom. According to Tedlock (2007), participation observation was created in the 19th century as a method for studying homogenous cultures; it allows the researcher to observe the "joys" and "sufferings" as a way to collect data. Participation observation is a method that produces information that is true and reflective of the participants' views about reality. For this study the researcher has chosen the position of being a relative outsider, the researcher interacted with the participants to gain an understanding of their beliefs and actions from the outside (Myers, 2009). Field notes were kept by the researcher (Chughtai and Myers, 2014). The field notes included notes on training

conducted for district officials, informal chats, and detailed notes on the pilot school, as well as lessons taught using tablets.

Myers (2009) claimed that when using a case study strategy most researchers opt for interviews. However, in this case the researcher decided to also use participation observation in order to gain a fuller picture of what was happening. The use of more than one research method is triangulation (Kaplan and Maxwell, 2005; Myers, 2009). Triangulation allows the researcher to strengthen the data through cross validation: it increases the robustness of the data results. Moreover, triangulation allows the researcher to view the topic from different angles (Myers, 1997; Kaplan and Maxwell, 2005). The data collected was analysed to identify patterns or common themes that cut across the data.

4.6 Sources of Data

During topic discovery and the development of this thesis, the researcher was introduced to the ICT4RED project. As discussed in Chapter 1, ICT4RED forms part of the larger TECH4RED (Technology for Rural Education Development) research initiative by the South African Department of Science and Technology (DST) in collaboration with the South African Department of Basic Education (DBE), the Eastern Cape Department of Education (ECDoE), and the South African Department of Rural Development and Land Reform (DRDLR) (Botha, et al., 2014). According to Botha, et al. (2014), TECH4RED was an initiative that aimed to improve rural education through technology. Within TECH4RED, ICT4RED supports rural teachers to integrate tablets in teaching with the aim of addressing the challenge of quality education in rural areas.

Cofimvaba in the Eastern Cape served as the pilot district, where the project targeted three senior secondary schools (Arthur Mfebe, Siyabalala and Kwahza) and six junior schools (St. Mark's, Bangilize, Mvuzo, Gando, Mtimbini and Zamuxolo) for Phase One of the ICT4RED project. Arthur Mfebe Senior Secondary School served as the pilot school of the project and as the research site for this particular study. The researcher chose Arthur Mfebe Senior Secondary School mainly because the project has been operational at the school since 2012. Additionally, at the time of data collection, Arthur Mfebe was the only school where the teachers had completed training and had been using the tablets for over one year (since 18 July 2013). The other schools within the Cofimvaba district were either completing teacher training or had recently received tablets for the students. None of the schools had been using the tablets for a

lengthy period of time, and this would have served as a limitation in obtaining data from the teachers in terms of their experience on tablet integration into the classroom.

Arthur Mfebe Senior Secondary School had a total of thirteen teachers. Only eight teachers actively used the tablets. The researcher was able to conduct in-depth interviews with five of these teachers and the technical consultant for the school. The small number of teachers also served as a limitation. However, due to the in-depth interviews, the participants provided the researcher with significant insight into their perceptions regarding ICT integration in the classroom and the role of training in their ability to integrate ICTs. In addition to the in-depth interviews, the researcher observed training conducted for District Officials and two lessons at the school where teachers used tablets in their teaching. The researcher also had the opportunity to observe the handing over of tablets for Phase Two schools. Chapter 5 will provide more detail on the context and the project.

4.7 Data Collected

Data collected focused on themes essential for answering research questions (Chapter 1) and was based on the conceptual framework generated from literature (Chapter 6, Figure 6.7). Data was collected on the following issues: barriers to integration (first-order and second-order), teacher attitudes towards ICT integration, how teachers integrate ICTs, training received, and the teachers' ability to integrate ICTs and other factors that influence ICT integration in the classroom. Additionally, data was collected on how the project was currently running in the school. Through interviews and participation observation, the researcher also aimed to gather data on the interviewees' attitudes and beliefs on ICT integration and on using ICTs in teaching and learning.

4.8 Interview Guide

Semi-structured interviews were used for this research. Myers and Newman (2007) have described semi-structured interviews as interviews with incomplete scripts where the researcher prepares questions but provides room for improvisation. The interview questions were used by the researcher as reminders or prompts regarding the information that was needed. Each question presented is expected to initiate a conversation where the participant provides their point of view on the issue at hand (Krauss, 2007). Two sets of interview questions were prepared: one set of questions was directed to the teachers and the second set of questions was for the technical co-ordinator. Interview questions are presented in Chapter 6, Section 6.3.

Field Procedures for Interviews

Lubbe (1998, cited in Krauss, 2007) outlined field procedures to ensure that a researcher conducted informative interviews. These field procedures were adapted as guidelines for conducting the interviews for this research. The following procedures were followed:

1. Firstly, the researcher used a gatekeeper who was a teacher at Arthur Mfebe.
2. The researcher made initial contact with the participants to get consent for conducting the interviews and using responses for research purposes. This was done with the assistance of the gatekeeper.
3. The researcher scheduled interviews at a convenient time in a relaxed and quiet setting, and ensured that enough time was available.
4. For ethical purposes, the researcher commenced each interview with a brief introduction of the intentions of the research followed by an explanation of the type of questions that were to be presented.
5. The researcher ensured that the interviewees understood that they were at liberty to withdraw from the project at any time. Furthermore, their responses were treated as private and confidential. The researcher ensured that the interviewees understood that the interviews would be recorded.
6. The researcher ensured that the interviewees did not object to being recorded.
7. Most importantly, the researcher requested that interviewees did not discuss interview content with other possible participants so as to avoid bias as far as possible.
8. During the interview, the researcher ensured that the interviewees were at ease at all times.

Leedy and Ormrod (2010) also provided guidelines for conducting interviews in qualitative research; the following suggestions were made by these authors:

1. The researcher must identify some questions in advance: conducting semi-structured or unstructured interviews requires skill and experience and the researcher must be able to sense when the interview is drifting and steer it back on

course. This researcher prepared probing questions based on specific themes from the literature as presented in Chapters 2 and 3.

2. The researcher needs to consider the participants' cultural background, as this might influence their responses, especially because interpretivism encourages the participants to express their opinions.

3. The researcher needs to ensure that interviewees are representatives of the group. In this case, the researcher needed to make sure that the participants were all teachers who used ICTs in their lessons.

4. The researcher needs to find a suitable location in order to conduct the interview. It is essential to find a quiet place where the interviewee is unlikely to get distracted.

5. Written permission is required from the participants. The participants therefore need to sign a consent form.

6. Establish and maintain rapport. Leedy and Ormrod (2010) mentioned that the researcher should begin the interview with small talk that will break the ice. The researcher should also remember to remain respectful and courteous at all times.

7. Researchers need to ensure that they do not put words into the participants' mouths.

8. Capture and record responses precisely.

9. It is essential that the researcher maintains a neutral face and does not show disapproval or surprise to responses given.

10. The researcher has to remember that all participants' responses are not facts but merely perceptions.

4.9 Data Treatment

There were two sources of data for this study, namely semi-structured interviews and participation observation. For each interview, the responses were recorded so that the researcher could align the answers to the questions from different interviewees and analyse the data for any themes or patterns. Thematic analysis, as presented in Braun and Clarke (2006), and the hermeneutic principles froma Klein and Myers (1999) were used to analyse data.

Thematic analysis is a data treatment method that focuses on identifying, analysing and reporting on themes or patterns found within qualitative data (Braun and Clarke, 2006). It requires the researcher to search and identify common threads that extend across an interview or a set of interviews. Even though thematic analysis shares many principles with content analysis, it additionally focuses on the qualitative aspects of the material being analysed. It moves beyond counting words or phrases. It focuses on both implicit and explicit ideas within data, therefore allowing the researcher to provide a rich, detailed, yet complex account of the data (Braun and Clarke, 2006).

According to Braun and Clarke (2006), thematic analysis allows the researcher to reflect on reality and to look at the data in order to "unravel" the surface of reality. It allows the researcher to combine the analysis of meaning within their particular context (Vaismoradi, Turunen and Bondas, 2013). Consequently, the researcher found thematic analysis appropriate. Braun and Clarke (2006) suggested a six-stage approach to thematic analysis:

Familiarising with data

The researcher is expected to be familiar with the data. This stage is where the researcher personally transcribes the interviews making sure to read and re-read the transcription noting down initial ideas.

Generating initial codes

Stage Two involves identifying and coding interesting features in the data that may form themes. At this stage the researcher is required to link extracts from the data to a code.

Searching for themes

Phase Three involves sorting codes into potential themes and gathering all data related to each potential theme. Here the researcher starts to analyse codes and consider how these codes can be combined under an overarching theme (Braun and Clarke, 2006).

Reviewing themes

Phase Four involves reviewing the themes. The researcher will be required to eliminate, merge or identify new themes. Furthermore, the researcher needs to develop a thematic map of the analysis.

Defining themes

Phase Five requires the researcher to refine the themes by continually analysing the data and generating clear themes.

Final report

Phase Six is where the researcher produces the final report.

Due to the underlying philosophy chosen by the researcher being interpretivism, latent themes were identified in the data. According to Braun and Clarke (2006), latent themes examine and interpret the underlying assumptions and ideologies of what is being said, unlike semantic themes, which simply provide a description of what was said. Because this research is qualitative in its nature and the underlying philosophy is interpretivism, latent themes could provide the researcher with a rich description of reality.

In addition to thematic analysis, and as an underpinning epistemological stance to interpretation, the researcher used the hermeneutic principles as proposed by Klein and Myers (1999). Hermeneutics is a major branch of the interpretivist philosophy that focuses on understanding the text as a whole and the interpretation of its parts. It focuses on the wider research context and takes into account the entire background environment of the research. Klein and Myers (1999) emphasised that these principles are essential for conducting and evaluating interpretive field research in Information Systems. These principles are concepts that help the researcher understand the data. The principles are as follows:

1. The main principle is the **principle of the hermeneutic circle**: This principle suggests that all human understanding is achieved through the movement of understanding the interdependent meanings of the parts and the whole that they form. Chughtai and Myers (2014) provided an example of when the researcher goes into the field to gain an understanding of the context. The authors state that when the researcher enters the field they are in a hermeneutic circle as they are required to continually engage in self-understanding and their understanding of the world and vice versa.

2. **Principle of contextualisation**: Klein and Myers (1999) stated that this principle requires critical reflection of the social and historical background of the research setting, so that the audience could see how the current situation under investigation developed. This requires the researcher to take into account the entire background

environment of the research. The researcher ensured this by presenting the problem statement in Chapter 1 and by gaining an understanding about the context.

3. **Principle of interaction between the researchers and the subjects**: In order to gain insight into the perceptions of teachers the researcher needed to interact with the participants. According to Klein and Myers (1999), social interaction with the participants is part of the interpretivist philosophy. It involves the reflection on how data collected was socially constructed through the interaction between the researchers and participants. This principle also emphasises that the researcher must understand that the participants, just like the researcher, can be seen as interpreters. Thus the researcher decided to use the field procedures discussed in Section 3.9 as a guide on how to interact with the participants.

4. **Principle of abstraction and generalisation**: This principle requires connecting the details revealed by data interpretation, through the application of principles of contextualisation and human understanding, to theoretical concepts that describe the nature of human understanding and social action.

5. **Principle of dialogical reasoning**: This principle requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research and the actual findings. It requires the researcher to acknowledge any prejudices that guided the research design, as they are the starting point of the researcher's understanding. This researcher needed to determine true prejudices from false ones due to misunderstandings by constantly reflecting.

6. **Principle of multiple interpretations**: This principle requires sensitivity to possible differences in interpretations among the participants, which are expressed in multiple narratives or stories of the same sequence of events under study. This principle is of importance as it encouraged the researcher to probe beneath the surface (Klein and Myers, 1999).

7. **Principle of suspicion**: This principle requires sensitivity to possible biases and systematic distortions in the narratives collected from the participants (Klein and Myers, 1999).

Klein and Myers (1999) stated that the application of these principles in interpretive research contributes to improving the interpretive field research methodology, as they require the

researcher to "read" the social world behind the words of the interviewees and understand human and social actions. However, it is important to note that these principles are not bureaucratic rules of conduct because their application requires creative thought (Klein and Myers, 1999). Nonetheless, this does not mean that the authors advocate irrational selection of some principles while ignoring others because to some extent the principles are interdependent. The researcher applied these principles in addition to thematic analysis.

4.10 Ethical Clearance

Researchers need to understand that participants in the research have rights, hence ethical clearance in research projects is compulsory because no research can proceed without ethical approval (Boynton, 2005). Ethical clearance aims to lower any risks associated with the participants and safeguard the participants in the research. It also aims to increase the value of the new information to be gained from the study. Full details about the proposed research were presented for ethical clearance to the Rhodes University Information Systems Department. This included letters sent to participants, consent forms, questions and a protocol for the proposed research. Moreover, CSIR (Council for Scientific and Industrial Research) Meraka also acquired ethical clearance from Department of Education to allow interviews to be conducted at schools. A pilot study was conducted before actual interviews are conducted. The pilot study involved four teachers in the Grahamstown area. Implementation of ethical clearance can be seen in the fieldwork protocol.

4.11 Conclusion

This Chapter describes the research methodology adopted for conducting this research. It starts by explaining the underlying philosophy, interpretivism, which is used to provide answers to the questions presented by the researcher. Research strategies are also discussed; the researcher decided to use qualitative rather than quantitative strategies mainly because the interest in dealing with meanings. Semi-structured interviews and participation observations are highlighted as the data collection methods used. The ICT4RED project is introduced to the reader as the case study for this research. All data collected by the researcher was recorded and analysed using thematic analysis. Hermeneutic principles are also discussed as a tool for analysing data. Furthermore, the Chapter provides the interview guide and field procedures used by the researcher when collecting data, as well as the importance of ethical clearance. The following Chapter will provide an in-depth explanation of the case study (ICT4RED project).

Chapter 5
Context Discovery

5.1 Introduction

In Chapter 4 the researcher described the research methodology adopted for conducting this research. The researcher also introduced the ICT4RED project as the case study where data would be collected. This Chapter aims to provide the reader with an in-depth understanding of the ICT4RED project by describing various aspects of the project.

This Chapter starts off by providing background information on the TECH4RED initiative. Thereafter the ICT4RED project is described. The involvement of CSIR is also discussed, and contextual information on Cofimvaba is provided. Lastly, the Chapter details the project initiation and implementation stages as well as teacher training provided within the ICT4RED project.

5.2 Overview of the TECH4RED Project

As mentioned in Chapter 1, during topic discovery and the development of this thesis, contact was made with CSIR Meraka Institute where the researcher was introduced to the ICT4RED project, which forms part of the larger TECH4RED project. In order to gain a full understanding of the ICT4RED project it is therefore important that one understands the role of TECH4RED, which is an umbrella to various initiatives such as the ICT4RED project.

TECH4RED is a research initiative by the South African Department of Science and Technology (DST) in collaboration with the South African Department of Basic Education (DBE), the Eastern Cape Department of Education (ECDoE), and the South African Department of Rural Development and Land Reform (DRDLR) (Botha, et al., 2014). The project is aimed at improving rural education through technology-led innovation. However, TECH4RED is not only limited to the domain of the education department alone but also focuses on a range of other factors. It is an initiative that is designed to holistically address all obstacles that hinder learning. Hence, the initiative does not only focus on introducing new technologies; it also works to improve basic infrastructure (Botha, et al., 2014).

According to Derek Hanekom, former minister of Science and Technology, attempts to improve education need to extend beyond the classroom because inadequate provision of water, sanitation, energy and transport, either at schools or where learners live, are factors that can

have a negative effect on learner performance (Vodacom, 2013). Hence, the TECH4RED initiative focuses on other factors such as:

- Health;
- Nutrition;
- Water and sanitation;
- Renewable energy;
- Science and technology; and
- Teacher and learner support.

5.2.1 ICT for Rural Education Development (ICT4RED)

As explained in the previous section, the ICT4RED project falls under the TECH4RED initiative. ICT4RED aims to explore how the application of new and existing technologies at schools in Cofimvaba in the Eastern Cape Province can assist in the development of a framework which can be replicated and scaled to other provinces in South Africa and across the rural education system (Botha, et al., 2014). ICT4RED does not aim to replace teachers with technology: it aims to support rural teachers in integrating tablets into teaching practices with the purpose of addressing the challenge of quality education in rural areas. According to Botha and Herselman (2013), the aims and objectives of the project are to:

- Design sustainable and systematic approaches to providing access to digital content for learners in poor marginalised rural schools in South Africa;
- Improve educational technologies, devices, platforms and processes that support the access to digital content for rural schools;
- Measure the effect of the ICT4RED project on 21st century skills for learners; and
- Inform policy in an integrated and coherent manner using evidence from the research.

CSIR Meraka Institute supports and implements this initiative, furthermore, CSIR has the overall project management responsibility. Cofimvaba in the Eastern Cape served as the pilot district. The initiative targeted 25 schools where various models would tested (Botha and Herselman, 2013). These models address ICT infrastructure, connectivity and integration into the school environment. According to Botha and Herselman (2013), once the research has

occurred, learning and models will be shared and disseminated, and a wider-scale rollout will follow.

5.3 The Council for Scientific and Industrial Research's (CSIR) Meraka Institute

CSIR Meraka Institute is a leading scientific and technology research, development and implementation organisation (CSIR, 2013). CSIR conducts multi-disciplinary research and technology innovation that contributes to the improvement of the quality of life of South Africans (CSIR, 2013). Former minister of Science and Technology, Derek Hanekom, in collaboration with the South African Department of Basic Education (DBE), the Eastern Cape Department of Education (ECDoE), and the South African Department of Rural Development and Land Reform (DRDLR), initiated the ICT4RED project to showcase the application of technology in supporting rural education (CSIR, 2013; Botha, et al., 2014) Cofimvaba school district in the Eastern Cape served as the pilot for the technologies (CSIR, 2013). The following section will provide contextual information on Cofimvaba.

5.4 The Cofimvaba School District

Cofimvaba is a small town situated east of Queenstown in the Eastern Cape. The village of Cofimvaba is the home of the late Chris Hani and Xhosa is the main language. Similar to many rural areas in South Africa, access to water, health services, proper sanitation and educational resources is limited in the area. Former Minister Hanekom chose Cofimvaba as the test-bed for the ICT4RED project. July 2012 was the beginning of Phase One of the ICT4RED project. Phase One targeted three senior secondary schools (Arthur Mfebe Senior Secondary School, Siyabalala and Kwahza) and six junior schools (St. Mark's, Bangilizwe, Mvuzo, Gando, Mtimbini, and Zamuxolo). These schools were selected in collaboration with Cofimvaba School District officials. Arthur Mfebe Senior Secondary School was the one school chosen as the pilot where all technology and models would be tested. The following section details the various project initiation stages and steps taken in introducing the project at the school.

5.5 ICT4RED Project Initiation and Implementation

In July 2012, Phase One of the project was initiated at Arthur Mfebe Senior Secondary School. According to Botha and Herselman (2013), Phase One of the project focused on testing different models with regard to devices, school preparation, content management processes,

support and maintenance and device management. Phase One was successfully implemented at Arthur Mfebe. The following steps were followed during Phase One:

Step 0: The project was explained to headmasters, deputies, and School Governing Bodies (SGB), as well as to the district officials. This was done to create buy-in. This step mainly consisted of meetings with these stakeholders.

Step 1A: Upon buy-in, the headmasters, deputies, and allocated ICT champions (allocated at the school) attended a workshop on change management and how to manage the technology in the school. At this stage each attendee received a tablet.

Step 1B: This step focused on creating buy-in and support from the top. A course on how to support tablet roll out in schools was conducted for all district officials. All district officials in attendance received tablets.

Step 2: This step focused on continued teacher professional development (teacher training) where teachers were equipped with skills on how to use ICTs in teaching. Teachers at this stage were expected to complete homework and show how they would integrate the tablets in their classroom.

Step 3: This step involved the installation of Mobi-kits (kits where tablets are charged and kept for safety), Mobi-hub, local Wi-Fi, and local content. The project team was responsible for this while teachers continued with training.

Step 4: While teachers continued with training, the students at the school received tablets and Wi-Fi was installed. A technical consultant was also appointed.

Step 5: This step involved the expansion of the project to other schools.

Execution of these steps ran in parallel with using textbooks in the classroom, as the project did not aim to replace the status quo. Rather it plans to support teaching and learning using mobile devices (Botha and Herselman, 2013). Thus, the project provides teacher professional development courses to equip the teachers with the skills to integrate the tablets into the classroom. This thesis aims to explore the teachers' perceptions regarding the courses they received and their ability to integrate ICTs. The following section discusses teacher development in depth and discusses the objective of training.

5.6 Teacher Training

As part of the ICT4RED project all teachers were expected to attend the ICT4RED Teacher Professional Development Course. Seventeen teachers from the pilot, Arthur Mfebe, participated in the course. According to CSIR (2013), the training provided for the teachers was different from the traditional methods of training where the focus would be on how to use technology. This training focused on equipping teachers with teaching strategies that would develop teaching methods using technology as a tool.

The course consists of ten modules. Each module equipped the teacher with an innovative teaching strategy, relevant assessment tools and technology skills (ICT4RED, 2014). According to Maggie Verster, the course co-ordinator, the course does not simply focus on how to use tablets: it is a course that aims to change teachers' practice from teacher-centred to learner-centred using hands-on teaching strategies (ICT4RED, 2014). As a result, Modules One and Two are the only modules that focus on using and caring for the device. Thereafter, Modules Three to Seven focus on using the tablet as a teaching device. Modules Eight to Ten focus on using the device for further learning and collaborations (ICT4RED, 2014). Upon completion of a module, teachers acquire a badge. Each module has one or more badges attached to it. The badges are used to represent a challenge where the teacher needs to apply a teaching strategy. The teachers are required to complete thirteen badges in order to graduate. In addition to the thirteen badges there are five challenge badges for teachers to work towards.

In order to obtain the badges, all teachers are required to present evidence to prove that they have applied the teaching strategy in their classroom and that they can integrate subject knowledge (content knowledge) and technology into a lesson. Evidence is presented to the badge facilitator, who evaluates the evidence and awards the badge. This is known as the "learn to earn" model (Botha and Herselman, 2013). Diagram 5.1 demonstrates the "learn to earn" model.

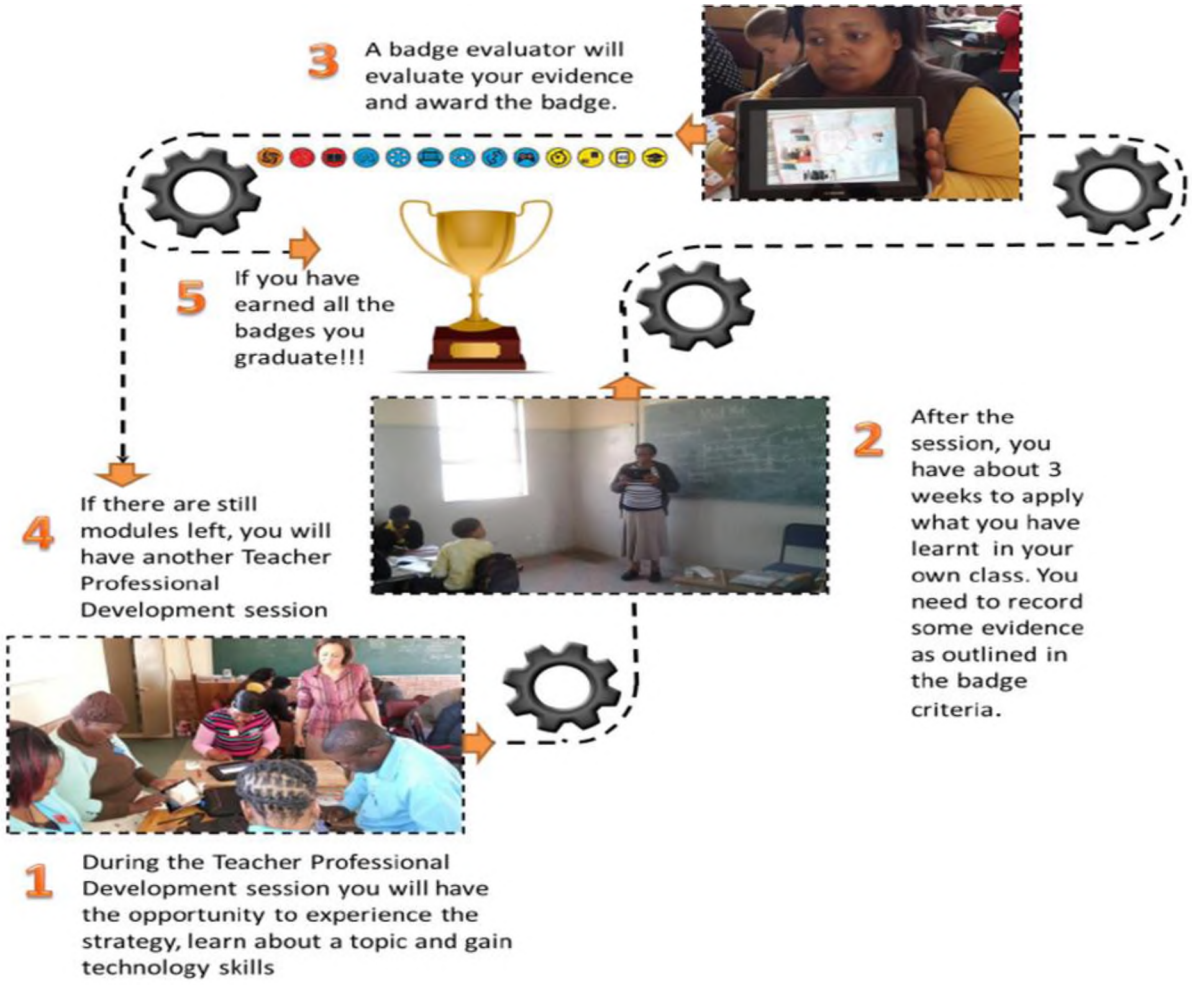

Figure 5.1 ICT4RED Teacher Professional Development Course phases (ICT4RED, 2014)

According to Botha and Herselman (2013), all training took place after school hours for three hours (14:00–17:00) every three weeks. The training is structured in such a manner that all teachers are able to actively participate in the training (Botha and Herselman, 2013; ICT4RED, 2014). Figure 5.1 illustrates the phases that teachers go through in order to graduate (as explained by the researcher). Teachers at Arthur Mfebe Senior Secondary School completed their training and graduated in July 2013. The teachers received tablets and after some time the students also received tablets. Section 7.3 will discuss the modules and their relation to the data.

5.7 Introduction to Observations

In Chapter 4, section 4.6 the researcher explained that data would be collected through semi-structured interviews and participation observation. The use of semi-structured interviews as well as participation observation focused on cross validating the data in order to increase the robustness of the data. Observations allowed the researcher to capture the whole picture and the context. The combination of these methods helped validate and reinforce interpretations of findings from the observations with the data obtained from interviews (Thurmond, 2001; Mulhall, 2003. This section provides the data collected from observations.

From Tuesday 27 May until Friday 30 May 2014, the researcher made the first field visit and observations. The second field visit was from the 28 July until 1 August 2014 where the researcher conducted interviews with teachers at Arthur Mfebe Senior Secondary School. Both visits provided the researcher with various opportunities to collect data. Table 5.1 sets out the various happenings.

First Field Visit	
27 May	Arrived at Queenstown to meet the project team. The researcher observed training conducted for District Officials. As indicated in Chapter 5, Section 5.8, this training formed part of Step 1B, which focused on creating buy-in and support from the top. Observed Modules 2 and 3.
28 May	The researcher observed Phase 2 at four different schools. Phase 2, as described in Chapter 5, Section 5.8, Step 3, involved the expansion of the project to other schools.
29 May	This day was spent at the pilot school, Arthur Mfebe Senior Secondary School. The time spent at the school provided the researcher with the opportunity to understand the context as well as the background of the school. Thereafter the researcher went to Queenstown to observe training conducted for district officials. Observed Module 7.
30 May	The researcher continued observing training in Queenstown, observed Module 8.
Second Field Visit	
28 July	Visited the school to prepare for interviews.
29-30 July	Interviewed available participants at Arthur Mfebe and observed two lessons (Mathematics and Agricultural Management Planning).

Table 5.1 Field Visit

During the interviews and observations, the researcher reflected and kept field notes about what happened on each day. Section 5.8 will provide an in-depth analysis of the training observations followed by observations made during Phase 2 (28 May). Lastly, observations made during the second visit will be discussed. For the following sections, the researcher will write in the first person. This intends to show immersion in the data collection and data write-up. Furthermore, this allows the researcher to present the data from her personal experiences (observations), as this is the assumption of interpretivism.

5.8 Training Observations

On my first visit (27 May), I attended training conducted for district officials. Botha and Herselman (2013) explained that this training for district officials forms part of creating buy-in from the top. In reference to the steps that the project undergoes, this training took place after the project had been explained; Step 1B in Section 5.5, describes the observation at hand.

The training conducted for these participants was the same training that the teachers would go through. All subject district officials were given tablets as well as the course guide. The training was very interactive and hands-on. The modules in the training varied from working alone to working in teams to create content. The use of participation observation in addition to interviews provided me with the opportunity to secure data within the mediums, symbols and experiential worlds of the interviewees (Vidich, 1995). Furthermore, participation observation placed me closer to the context and social change. It provided me with deep insights on the teaching conditions as well as the teachers' work environment, thus allowing me to gain a deeper understanding of the interviewees and the context. During my visit I observed the following modules:

Module 2 Story Telling: This module focused on using story telling as a teaching and learning strategy. The participants were required to use KingSoft (which is similar to Power Point) to collaboratively tell a story. According to the ICT4RED module, the outcomes for this module included exploring the use of the mobile device by:

- Watching a video;
- Using a slideshow app to visualise a story board;
- Writing a journal entry using a journalling application;
- Taking and editing a picture; and

- Using Bluetooth to share files.

The participants enjoyed this module and found it easy to complete; those who struggled assisted each other. Completion of this module earned the participants a badge. An optional e-mail badge was attached to the module. This module demonstrated how teachers could incorporate tablets into the classroom by allowing students to present a topic they have mastered. Similar to other modules, this module allowed the students to work independently and encouraged student-centred learning. This is in line with the purpose of training, which aims to change teacher practice from teacher-centred to learner-centred using hands-on teaching strategies (ICT4RED, 2014).

Module 3 Role Play: Role play also encouraged group work. It allowed participants to have fun while acting out serious issues. According to ICT4RED (2014), this module can be used by the teacher to create real-life scenarios where students record themselves acting out the scene. This module focused on creating discussions and allowing the students to think independently. Chen (2008) emphasised this in his paper claiming that teachers do not only need to encourage the students to have discussions, they must also encourage students to have multiple viewpoints and to be able to debate their own opinions. This module demonstrates student-centred learning (constructivism), where learners are encouraged to become active knowledge constructors rather than passive learners (Pelgrum, 2001; Wilson-Strydom and Thomson, 2005; Chen, 2008;Naicker, 2010). The module creates a real-life situation and allows students to debate, thus demonstrating principles of active learning and social interactions as discussed in Chapter 3.

Module 7 Game Based Learning: This module was conducted on 29 May, the training focused on using gaming as a teaching and learning strategy. Participants were required to watch videos on copyright and licensing, and thereafter they had a quiz to test their acquired knowledge. In addition to the quiz, the participants were also broken into groups where they made music and competed against each other. According to the ICT4RED module, the outcomes for this module included exploring the use of the mobile device by:

- Playing electronic games such as Angry Birds that allow students to learn about mathematical and physics concepts;
- Playing quiz games;
- Using a spreadsheet to keep points; and

- Making music.

This module provided the participants with examples of games that the students can play in order to broaden their general knowledge as well as their subject-specific knowledge, e.g. "Kids Maths". The module also provided teachers with various examples of gaming applications that can be used in the classroom. The module highlighted that ICTs have the ability to foster co-operative learning and encourage autonomous learning amongst the students (Kirschner and Selinger, 2003; Wilson-Strydom and Thomson, 2005; Madumere-Obike and Imgbi, 2012).

Module 8 Field Trip: On the last day of my first field visit I observed Module 8. This module focused on using field trip as a teaching strategy. The module demonstrated the principle of situated learning, as described in Chapter 3, which states that learning should occur in a real-life context (Ramorola, 2013).

The module used Quick Response (QR) Codes in an educational setting and like many other modules it encouraged teamwork. The participants were required to go on a "hunt" for QR codes that would provide them with geographical information or instructions on what to do in order to gain points. Examples of instructions included taking a video of the group or taking a picture of something yellow in order to gain points. The team with the highest points within the time limit won the challenge.

According to the ICT4RED module, the outcomes for this module included exploring the use of the mobile device by:

- Reading/scanning QR codes;
- Taking photos and making collages;
- Taking videos and watching videos; and
- Reading geographical information.

This module demonstrated how teachers can use the tablets to give students a real-life experience outside the classroom. The district officials found this very exciting and challenging. They engaged with the module and were extremely competitive.

The training and the modules provided a focus on various ways that the teachers can use ICTs in teaching and learning. The training went beyond simple computer skills, such as word-

processing: it focused on making sure that teachers are knowledgeable when using computers to prepare their lessons (Jones, 2004, cited in Naicker, 2010). The training provided practical teaching strategies that focus on developing appropriate teaching methods in the classroom using technology as a tool. Furthermore, there was evidence within the training and the course material that the focus was on changing the teachers' practice from teacher-centred to learner-centred using hands-on teaching strategies (ICT4RED, 2014).

With reference to the way in which the training was conducted, Sang, et al. (2010) encouraged teacher training that was carried out in a constructivist manner as this provides a non-threatening environment. The environment where the training was conducted was constructive as the participants were encouraged to participate. They were able to experience success in computers and gain confidence in using computers (Teo, 2009). Davis, et al., (2009) also stated that training needed to be conducted in the same manner that the teacher is expected to integrate ICTs in the classroom in order to encourage integration, which was the case in the ICT4RED project. Training was conducted in the same manner that teachers were expected to use in their classes; it was hands-on and interactive. It moved beyond simple computer skills as it provided support for the teachers and prepared them on how to use the tablets in the classroom. It was carried out in a constructivist manner where teachers were encouraged to learn independently as well as to work collaboratively. They were given the opportunity to ask and to interact with the training facilitator in order to solve problems. The training most definitely encouraged generative use of ICTs. In addition to the training I also observed Steps Three and Four (the installation of Mobi-kits and handing over of tablets to learners) of Phase 2 at four schools (Siyabalala Senior Secondary School, Kwahza Senior Secondary, Mtimbini and Bangilize). The next section discusses observations made at these schools.

5.9 Phase 2 Observations of Project Initiation and Implementation

As mentioned above, part of the first field visit involved training as well as handing over of tablets. On the second day of the first field visit, I visited four different schools where tablets were handed to students and where Mobi-kits were delivered. These observations assisted me in understanding the context, the school environment and the involvement of the community. Part of the handing over of the tablets included inviting parents and the School Governing Bodies (SGB) to witness the event. This was a strategy to facilitate buy-in and ownership from the community. The following schools were visited (pseudonyms will be used in this section in order to protect the identity of schools):

School A, and the other schools in the project, received 15 tablets. The school has a highly secure computer lab with desktops and an air conditioner installed. According to the teachers, the computers were used for computer lessons mainly for Grades 7 to 9. The concept of implementation without integration was evident here, with ICTs being used in a representational manner only, rather than in a constructivist manner (Hermans, et al., 2008; Liu, 2011). Even though constructivism is encouraged, Bialobrzeska and Cohen (2005) noted that generative use (implementation with integration) is not a norm in South African schools, as is the case with School A.

School A had a strict headmaster who showed ownership and initiative when it came to the project. The headmaster himself was involved in the training. He expressed technical problems that the staff had with the tablets and instructed them to also take action and report any additional technical difficulties. The headmaster and the teachers seemed excited. School A involved their SGB and parents. School leadership and creating buy-in were important in this project. Hew and Brush (2007) noted that school leadership has the potential to hinder or support the integration of ICTs. If the headmaster does not understand and support ICT use, teachers are likely not to integrate ICTs. Headmasters are seen as managers and change agents who should work with the staff to create a vision for technology implementation and an environment that promotes integration (Flanagan and Jacobsen, 2003; Hew and Brush, 2007; Eteokleous, 2008).

School B, like School A, was one of the schools that had better facilities. However, School B had fewer teachers attending the hand over. The headmaster was not present. According to one of the team members, this school normally has a high rate of teacher absenteeism and the headmaster was not very supportive of the programme. Despite the absenteeism of teachers and the headmaster, the parents and SGB showed support and enthusiasm. This school even conducted a session for the parents and SGB to show them how the tablets would be used. At this school I observed the importance of involving the SGB and parents.

School C did not have good infrastructure. Classrooms were dusty with very little furniture and the students were from a relatively isolated area. The headmaster at this school took the initiative in the project and was the one heading the handover. Like School A, the headmaster was using the tablet and instructed his staff to take the initiative in not only reporting any technical problems but also in encouraging the students to use the tablets immediately. The important theme of leadership and creating buy-in from parents emerged from this visit.

School D, unlike the other schools, was extremely underdeveloped. The school had a total of three teachers, including the headmaster. Teachers at this school were each responsible for three different grades. The concept of multi-grading is therefore applied at this school, i.e. teachers have students of different grades in one class. The school is extremely isolated and has problems with electricity and managing the large number of students. The headmaster mentioned that they planned to use the tablets to manage the classroom and encourage the students to work independently. Here the concept of constructivism and generative use was evident. Barriers such as lack of infrastructure (electricity) were evident. Parents and SGB at this school were united in indicating that they would go to the provincial office to discuss the problems concerning electricity in the area. From the observations the following emerged as important factors that affect the acceptance and integration of tablets:

- **Headmaster's role:** Headmasters play an important role in ensuring the acceptance of ICTs. They are responsible for steering the team and creating an environment where ICTs can be used, despite the facilities and availability of resources (Flanagan and Jacobsen, 2003; Hew and Brush, 2007; Eteokleous, 2008). The attitude and drive of the headmaster is important in ensuring integration.

- **Creating ownership and buy-in**: Buy-in from parents and the SGB is another theme that emerged. According to Ballantyne (2003), buy-in is one of the critical success factors that need to be considered as it plays a significant role in ensuring local buy-in and the sustainability of projects. Ownership was created from Step 0 and extended to Step 3 when the tablets were handed over. During the hand-over, the team emphasised that the students should hold their teachers accountable and ask them where the tablets were if they were not using them. The project team encouraged the parents to ask their children if they were using the tablets to learn.

- **Relationship building**: At all the schools the presence of the parents and SGB indicated the importance of relationship building within the school and outside the school. It also emphasised the importance of teacher-parent relationships in ensuring successful education.

5.10 Arthur Mfebe Senior Secondary School Observation

Upon the first visit to Cofimvaba, I also had the opportunity to visit the pilot school. During the visit I observed matric students who were using their tablets to do an Economics

assignment. They expressed that they found learning more interesting now that they were using tablets. The students were working in groups without the supervision of the teacher. This indicated that ICTs could be used to encourage autonomous learning, where the teacher is the facilitator rather than the main transmitter of knowledge. Literature discusses this in depth (Pelgrum, 2001; Wilson-Strydom and Thomson, 2005; Baeten, et al., 2010; Naicker, 2010).

5.11 Classroom Observations

On the second visit I observed two lessons where the teachers integrated tablets. Lesson One was a Mathematics lesson for Grade 11. The teacher demonstrated the JIGSAW teaching strategy; in conducting the class the teacher had to use only half of the students because the class was large and it would be impossible to conduct the class with all the students. The JIGSAW strategy required the students to work in groups to solve a mathematics problem and to record each other. The teacher mentioned that this strategy is normally difficult to conduct with large groups of students as the students need to be split into groups and to move around into other groups. The lesson was effective and allowed the students to learn collaboratively. It allowed the teacher to cover more work as the students learnt from one another. However, the strategy would be difficult to use in large classes; hence the teacher split the class before the lesson.

Lesson Two was an Agricultural Management planning lesson where the teacher demonstrated how the students used the tablets to capture their business plans. The teacher mentioned that they experienced technical problems as some tablets had applications that did not work. Both lessons required students to work in small groups in order for the lesson to be successful. This meant that some teachers might avoid using certain strategies due to overcrowded classrooms, thus leading to limited integration or no integration. The use of tablets in the classroom also required the students to interact with each other and to discuss, meaning that the teacher would find it easier to control smaller numbers compared to a class of thirty-something students, which is the case in many marginalised schools. Classrooms are overcrowded and difficult to control. Nonetheless, during the lessons the students worked autonomously, and they showed confidence and enthusiasm in their work (Kirschner and Selinger, 2003; Wilson-Strydom and Thomson, 2005; Madumere-Obike and Imgbi, 2012). As discussed in Chapter 2, these observations highlighted the positive impact of ICTs in schools. They also highlighted the importance of creating buy-in as well as leadership.

In summary, the following themes emerged from the observations. Teacher training provides teachers with strategies and methods that allow them to integrate ICTs into the classroom. Training is conducted in a constructivist manner where participants are encouraged to participate. Stages of project initiation and implementation highlighted the importance of the headmaster's role, creating buy-in and relationship building as factors that have an impact on integration. From classroom observations, it occurred that integration might not be an option for some classes due to the number of students (overcrowded classrooms limit ICT integration). Furthermore, the observations also indicated that using ICTs in the classroom motivates the students.

5.12 Conclusion

This Chapter discusses observations from the first field trip and the second field trip. During the first field visit the researcher observed training as well as Phase Two of the project, where tablets were handed out to new schools. The training provided the researcher with an understanding of the modules as well as the environment in which the training took place. Phase Two involved visiting schools to hand out tablets. Observations from Phase Two were informative as they allowed the researcher to understand the school environment. Lastly, the Chapter provided the researchers' observations of lessons on the second visit. This Chapter therefore has discussed both visits and the data gained. Chapter 6 will continue with data analysis providing the reader with interview analysis and the findings.

Chapter 6
Interview Analysis

6.1 Introduction

This Chapter builds on Chapter 5, which discussed the observations from field visits. It focuses on the interviews; hence it will provide the reader with the steps taken to analyse the data using thematic analysis. It will also provide the reader with the interview questions and the reasons for the questions. Most importantly, this Chapter will provide the reader with the thematic analysis results by elaborating on emergent themes from the data. Thematic maps are presented and explained to the reader. Similar to Chapter 5, this Chapter will be written in the first person. Writing in the first person provides the researcher with the opportunity to present the data from her personal experiences, as this is the assumption of interpretivism.

6.2 Doing Interviews

As mentioned in Chapter 4, I conducted in-depth semi-structured interviews with six participants (five teachers and one technical consultant) at Arthur Mfebe Senior Secondary School, the pilot school for the ICT4RED project. The interviews allowed the participants to express their experiences and views (Kaplan and Maxwell, 2005; Davies, 2007). For all interviews I went in with an incomplete script, with all questions providing room for improvisation and opportunities to steer the conversation (Myers and Newman, 2007; Shultze, 2011). During the interviews I focused on engaging the participants in a conversation where they provided their account of reality. As a result, I tailored the interview questions for each participant and focused on their perceptions (Myers and Newman, 2007; Shultze, 2011). All interviews were in-depth and time consuming (in some cases almost 90 minutes). They encouraged the participants to express and elaborate on their responses. The incomplete scripts allowed for improvisation. The probing questions assisted in steering the discussion. Each of the questions covered a theme obtained from literature (Krauss, 2007; Shultze, 2011).

The in-depth interviews with the five teachers and the technical consultant from Arthur Mfebe Senior Secondary, provided me with rich data. According to Schultze and Avital (2011), rich data is data where the participants impart knowledge of the social situation. It is "implicated in bringing to life the human beings that are the centre of social science research" (Schultze and Avital, 2011:3). Additionally, rich data is regarded as key to lending credibility and strength to qualitative research (Brekhus, et al., 2005). The use of interviews required the use of the

principle of suspicion (see Chapter 4, Section 4.9), which requires researcher sensitivity to possible biases. Interviews also required me to interact with participants, thus demonstrating the principle of interaction between the researchers and the subjects, in order to gain insight into the perceptions of teachers.

6.3 Process of Analysis

All interviews conducted were recorded and analysed using thematic analysis. The interview questions provided below were used by the researcher as reminders or prompts regarding the information that should be collected. Each question presented was expected to initiate a conversation where the participant would provide their point of view on the issue at hand (Krauss, 2007; Shultze, 2011). Two sets of interview questions were presented; one set of questions was directed to the teachers and the second set of questions was presented to the technical consultant. All interview questions engaged the participants in a conversation with the researcher where the participants provided their account of reality (Shultze, 2011).

The following questions are probing questions that the researcher used to steer the discussion; each of the questions covers a theme obtained from literature, e.g. first-order and second-order barriers were addressed by Question 2 (*What challenges have you experienced with using the tablets in the classroom?*) and Question 3 (*What factors discourage you from using ICTs?*). Other themes emerged during the interviews. Themes and interview questions are presented in Table 6.1 that follows.

Theme	**Interview Question and Reason for Question**
Teacher attitude (second-order barrier)	*How do you feel about using tablets in the classroom?*
	This question aimed to determine whether the teachers saw any value in using ICTs in the classroom. According to Huang and Liaw (2005), teacher attitudes towards ICTs affects successful use of ICTs in the classroom. Teachers with a positive attitude towards ICT use are most likely to integrate ICTs, hence it is essential to ensure that teachers understand the advantages of using ICTs in the classroom. This question focuses on the teachers' perceptions regarding the usefulness and value of ICTs in schools and education.
Barriers to integration (first-order barriers: context, ICT support, access)	*What challenges have you experienced with using the tablets in the classroom?*

Theme	Interview Question and Reason for Question
	Literature highlights barriers and traditional educational settings that hamper ICT integration. Ertmer, et al., (2012) particularly highlights first-order and second-order barriers. This question aimed to draw out these factors, mainly first-order barriers that lead to limited integration.
	What factors discourage you from using ICTs?
	Ertmer, et al., (2012) described barriers that limit ICT integration. This question aimed to uncover barriers that were specific to the context and that affected the teachers directly: barriers that limit integration. This question encourages teachers to provide their perceptions.
Enablers of ICT integration (training, self-efficacy, computer self-efficacy)	*When you compare yourself to the time when you started using the tablets do you feel that your confidence in your skills has impacted your decision to use the tablets?*
	According to the TPACK model of Koehler and Mishra (2009), the teachers' ability to bring together content knowledge, pedagogy skills and technology skills highly affects ICT implementation and integration in the classroom. Second-order barriers such as confidence have an impact on the teachers' decision to integrate ICTs or to abandon them. This question therefore aimed to uncover whether exposure and continuous ICT use have an impact on teacher confidence. Furthermore, it aimed to highlight the importance of teacher computer efficacy and confidence.
ICT integration	*How do you use the tablets in your lessons? (What kind of activities do the learners do?)*
	This question aims to determine if teachers use ICTs in a generative manner or a representational manner. According to Du Plessis and Webb (2008), computers in most schools are used in a representational manner where the focus does not lie on utilising ICTs to broaden knowledge or develop problem-solving skills. Representational use limits the impact of ICTs across the curriculum. This question aimed to provide insight into the level of integration or the phase of integration of the teacher. Furthermore, it would provide insight into whether

Theme	Interview Question and Reason for Question
	teachers understand what is meant by ICT integration.
	Before the tablets what would a typical lesson be like? (Traditional chalk and board way of teaching, reading from the text book etc., or do you encourage group work and self-learning?)
	This question aimed to determine the teachers' pedagogical beliefs about teaching and learning as these play a critical role in the adoption and integration of ICTs in the classroom. Several studies theorise that teachers with constructivist practices and student-centred beliefs are associated with high-level use of computers whereas low computer use is associated with traditional beliefs (teacher-centred practices/instructivism). This question therefore aimed to understand the pedagogical beliefs of teachers in order to determine whether they were likely to integrate ICTs. It aimed to understand barriers that lead to limited integration of ICTs.
	What is your understanding of ICT integration in the classroom?
	According to Wilson-Strydom and Thomson (2005), some teachers might view integration as typing a word document, whereas integration requires ICTs to be interwoven into teaching and learning. This question therefore aimed to explore how teachers viewed integration and how they defined integration. Furthermore, Chen (2008) explained that some teachers do not integrate ICTs because they lack the theoretical understanding of constructivist practice.
Professional development/teacher training	*Have you received previous training on ICT use in the classroom?*
	Literature highlights training as an important aspect to ensuring that teachers integrate ICTs, hence this question aimed to determine the kinds of training offered to teachers and the skills they obtained from the training.
	Do you feel that the training provided you with enough skills to use ICTs in the classroom?
	This question aimed to explore the teachers' perspectives regarding ICT training that they had

Theme	Interview Question and Reason for Question
	received. It allowed the teachers to reflect on the skills they obtained and determine whether those skills adequately prepared them with the ability to integrate ICTs into the classroom.
	What changes would you have made in that training in order to encourage computer use?
	This question required teachers to make suggestions on how training can be improved to ensure integration in the long run.

Questions for Technical Consultant	
In your opinion what are some of the main factors that lead to teachers not using the tablets?	The answer to this question would highlight the main barriers to integration and ICT use in the school. The technical consultant would be able to provide insight from a technical perspective as well as a practical perspective.
When teachers use the tablets what are some of the common ways that they use them?	This question aimed at determining the type of ICT use. Chapter 3 discussed two main types of ICT uses. The Chapter highlights that in South Africa generative use is not a norm. Thus this question aimed to explore the use prevalent in the school, bearing in mind that training was focused on encouraging generative use. The answer to this question would provide the researcher with insight into factors leading teachers to use ICTs in a representational manner.
Which teachers use the tablets more than others? *Would you say that use and integration are dependent on the subject?* *Give me an example of how you make sure that ICTs are used in most subjects?*	This three-part question aimed at identifying whether subjects affect ICT use and integration in the classroom. It also aimed to determine which subjects were most likely to use ICT and how ICTs are used.
What traits would you associate with teachers who generally use the tablets? (Are these teachers willing to try new things? Are they interested in technology and teaching?)	This question aims at determining traits and characteristics of teachers who integrate ICTs. The answer to this question would provide the researcher with possible reasons as to why some individuals integrate ICTs whilst others don't. This question provided insight on teacher pedagogical beliefs as discussed in Chapter 3.

As technical support what are the main technical problems that you deal with?	This question aimed to highlight the technical constraints that result in ICT implementation without integration.

Table 6.1 Interview Questions

All interviews were analysed using thematic analysis where I focused on identifying themes relevant to the study as these would be subjected to further interpretation (Braun and Clarke, 2006). In combination with thematic analysis, hermeneutic principles were also used in order to gain an understanding of the data (see Section 4.9). Themes were deductively obtained from literature and inductively acquired from interviews and observations. The combination of these themes obtained deductively and inductively assisted me in establishing that there was a correlation between literature and the themes observed from the research context (Hayes, Heit and Swendsen, 2010). To obtain inductive context-specific themes, the researcher applied Braun and Clarke's guide to doing thematic analysis. The researcher followed the following phases:

Phase One: This initial phase involved the transcription of all interviews. The process of transcription required the researcher to take account of all the verbal and non-verbal utterances mainly because of the interpretivist nature of the study (Braun and Clarke, 2006). Through listening to the interviews, the researcher gained a thorough understanding of the data. Re-reading the transcriptions also provided the researcher with an idea of emerging themes and ideas amongst the various interviews. This assisted in Phase Two.

Phase Two: At this phase, the researcher focused on generating codes for the data; see Table 6.2, Column 2. These codes described interesting features within the transcriptions. Each code is linked to an extract from the interview. Table 6.2, Column 1 provides an example of the data extract linked to a code presented in column 2. Some of the codes were discussed by more than one interviewee; as a result, these codes and data extracts were grouped together. For example, code "content concerns" was mentioned by four different individuals in different lines as indicated in Table 6.2.

Data Extract	Code	Line in Transcript
"The unavailability of budget, we do not have a budget as ICT. We do not have a budget to buy these cables to connect to the project... Even routers, we do not have and we cannot access internet, even the learners are not connected, we need to go to the clerk's office to be able to access the internet." [Participant A]	• Concerned about the unavailability of ICT budget • Lack of resources such as cables (no budget) • Internet connectivity is limited	18-23
"Science and Mathematics people have most content on the tablet and I have to upload my content." [Participant C]	• Concerned about content • There is a need for content creation	70-74

Table 6.2 Coded Data Extracts

Phase Three: Execution of this phase required the researcher to sort the codes into candidate themes. At this point the researcher had a list of codes and data extracts linked to the different codes, as shown in Table 6.3. This phase allowed the researcher to "group" these codes under overarching candidate themes. The researcher ordered the extracts within possible themes (Braun and Clarke, 2006). For example, all codes connected to data extracts about lack of content were put under the candidate theme "Lack of Subject Content".

Data Extract	Code	Line in Transcript
"Even though I do not have enough content that is loaded on the tablets because the people who are benefiting from the project are the math and science so you find that for some subjects there is no content at all." [Participant A] "There is plenty of information for math and not all the other subjects." [Participant B]	Concerned about content	2-5; 138-141; 205-206; 209-210; 70-74; 124-127

Table 6.3 Data extract classified under one code

Phase Four: This phase required the researcher to refine the candidate themes into final themes and also define sub-themes. Table 6.4 illustrates themes and sub-themes as well as the data extracts. The researcher had to ensure that the sub-themes aligned with the main themes. At this phase the researcher read the extracts, the codes and the candidate themes. Based on these, the researcher highlighted a main theme, based on the candidate theme. For 'Lack of content' the main theme 'Lack of resources' emerged.

Candidate Theme	Sub-themes	Data Extract
Lack of subject content	Limited content on the server Teachers need to create own content Lack of content leads to use of text books	"Science and Mathematics people have most content on the tablet and I have to upload my content." [Participant C] "There is plenty of information for math and not all the other subjects." [Participant B]

Table 6.4 Candidate theme and sub-themes

Phase Five: At this stage the researcher focused on mapping the identified themes on a thematic map (see Figure 6.1, Thematic Map). This phase is where the researcher began to interpret the data by linking the themes to sub-themes and looking at the relationship between the two. This phase provided the researcher with the opportunity to also identify the themes that apply to the study. Figure 6.1 illustrates an example of the main theme that the researcher found within the data, for example, 'Lack of support' is a theme that emerged from the interviews. The interviewees explained that particular subject advisors were trained by the Department of Education to support teachers in the classroom yet they do not do so. The data extracts related to this theme are from different lines in the transcript.

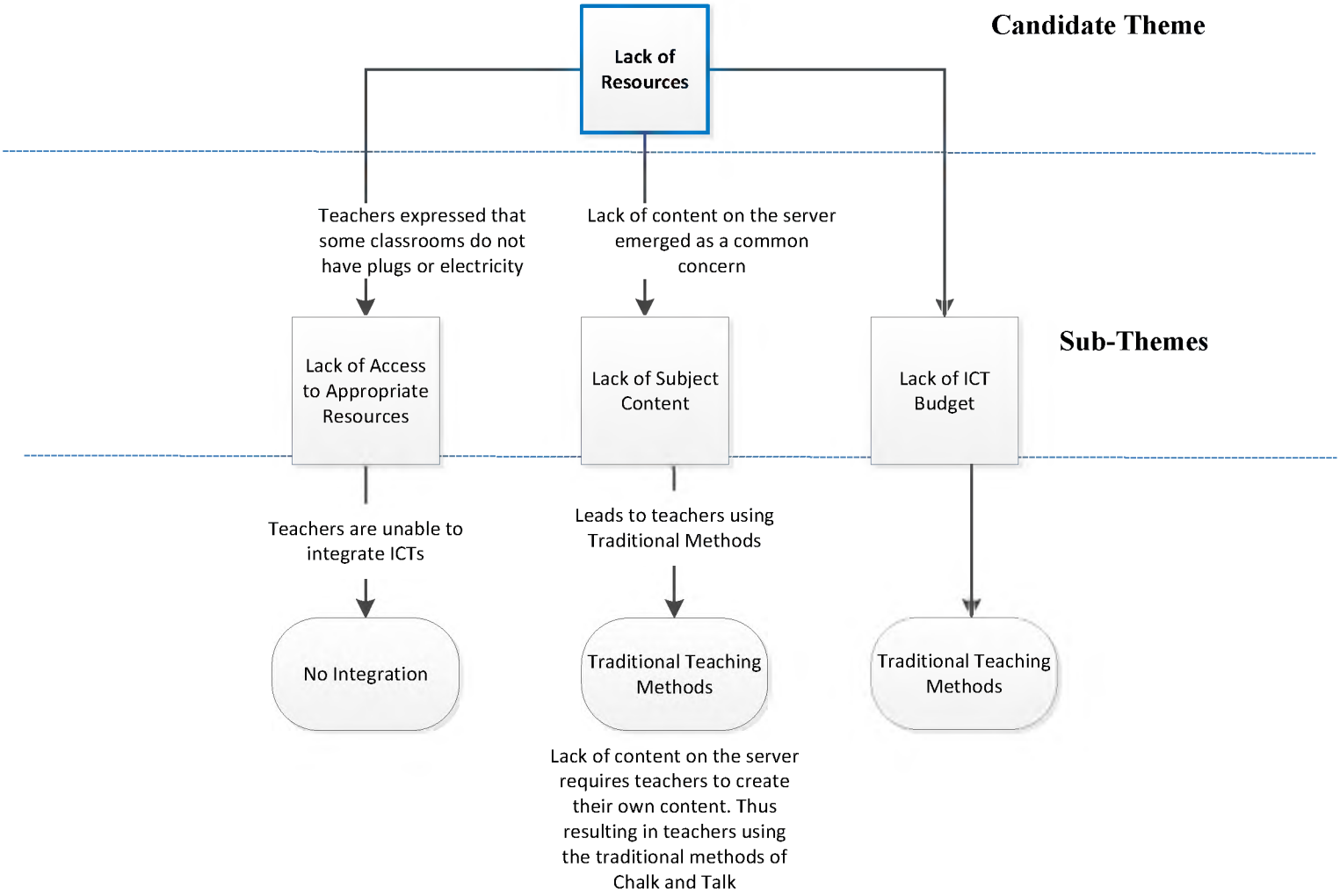

Figure 6.1 Lack of Resources Thematic Map

Phase Six: This phase concluded the analysis process, resulting in a narrative based on the researcher's interpretations, which will be discussed in the next section. However, initially a synopsis of the characterisation of the interviewees will be provided.

6.4 Characterisation of the Research Participants

As indicated above, the researcher interviewed five teachers and the technical consultant at Arthur Mfebe Senior Secondary School. The following section will provide information on the participants. In order to protect the identity of the participants the researcher will not use the names of the interviewees but will refer to them as A, B, C, etc.

Characterisation of Participant A:

Participant A was an English teacher at the school who was passionate about ICTs and education. The participant's passion was demonstrated through her involvement in the

ICT4RED project as an assessor and her enrolment to complete a Master's degree in ICT management in the classroom.

Participant A has attended previous ICT training before the ICT4RED initiative. The participant has been teaching for six years and has been at the school for two years. This participant's background in research and passion for the project impacted her transparency and sharing of concerns, thus providing valuable information regarding the progress of the project.

Characterisation of Participant B:

Participant B is a temporary teacher who has been at the school for only two years and has been teaching for two years. Similar to participant A, this teacher has been exposed to ICT use before the ICT4RED project. The participant's experience with ICTs was mainly at university. This participant was one of the youngest teachers at the school. Even though the participant did not have professional teacher training, the participant showed passion for ICT use. This participant also headed up the school's Agricultural Programme, where she allowed the learners to do their business plans and any project documentation on the tablets.

Characterisation of Participant C:

Participant C was a Xhosa teacher at the school, who had been teaching for five years. Unlike Participants A and B, Participant C mentioned that before ICT4RED training she had not had any previous ICT training. Furthermore, the participant had never imagined how ICTs could be used in the classroom. Participant C also does not have professional teacher training but nonetheless this teacher showed enthusiasm about teaching and ICT use in the classroom.

Characterisation of Participant D:

Participant D was a Mathematics teacher at the school. This participant had been teaching for five years. The participant had received numerous sessions of ICT training and was very passionate about ICT use. Participant D mentioned that before ICT4RED he used ICTs in the classroom but in a limited manner.

The participant mentioned that the project had opened up opportunities for him as he was afforded the opportunity to attend a conference and the opportunity to link with

people in the outside world. Furthermore, this teacher owned an internet café in town and also sat on the school's ICT committee. His interest in ICTs was also personal, as he mentioned, hence he needed to be aware of what was happening in the world of ICTs.

Characterisation of Participant E:

Participant E was a technical consultant at the school. He had an IT background and has been in the IT field since 1999. This participant was employed to deal with technical problems at the school. The participant also mentioned that he occasionally assisted in the school with teaching. Participant E's passion was demonstrated through his participation in the ICT committee and rendering assistance within the school that went beyond his commitments. Participant E provided a different perspective to ICT use in the classroom.

Characterisation of Participant F:

Participant F was an Economics teacher at the school. He had been teaching for twelve years and had immense content knowledge. Participant F mentioned that he received previous ICT training before the ICT4RED project where he learnt computer literacy skills. The participant highlighted that the ICT4RED training was different from all the other kinds of training that he had received and that he enjoyed using the tablet in his lessons even though it was challenging at times. Interaction with this participant showed that the participant was passionate about the project and about the learners' development. Participant F was also involved in the school ICT committee.

6.5 Results of Thematic Analysis

After transcribing the interviews, I was in possession of 400 Mb of interviews and over 55 pages of textual transcription. Using thematic analysis, I was able to analyse the data and draw out emergent themes. The following section will discuss themes that emerged from the interviews. The participants did not explicitly mention some of the themes, but this analysis was based on the researcher's interpretation of the data (Krauss, 2007). The themes discussed below illustrate the concerns of the participants.

6.5.1 Lack of Resources

As anticipated, the participants highlighted a few first-order barriers. These barriers contribute to the limited use of ICTs in schools. Typically, they are referred to as extrinsic to the teacher and form types of resources that are inadequately provided. These resources range from equipment, technical support, and lack of access to appropriate resources such as hardware, software and internet, to mention a few (Ertmer, 1999; Donnelly, et al., 2011). Lack of resources emerged as main theme from which sub-themes **lack of access to appropriate resources, lack of ICT budget** and **lack of content** emerged.

6.5.1.1 Lack of Access to Appropriate Resources (Hardware)

According to Wilson-Strydom and Thomson (2005) and Hew and Brush (2007), lack of access refers to the correct amount and type of ICTs in places where teachers and learners can use them, in order to ensure that ICTs are integrated into lessons. Lack of access to appropriate resources is a sub-theme defined by the fact that the participants cannot use tablets in certain classrooms due to lack of appropriate resources such as electricity or plugs in those classrooms. The following statement by Participant B demonstrates this:

> *"I am not implementing the strategies due to lack of resources ... We don't have plugs on that side of the school and we don't have electricity..."*

This sub-theme also highlights the lack of hardware such as routers and cables, which would allow the teachers to integrate the tablets effectively into the classroom. Participant A mentioned that the lack of resources (hardware) such as routers and cables to connect to projectors can be attributed to limited integration. Lack of routers limits connectivity to the internet thus limiting what the learners can do on their tablets.

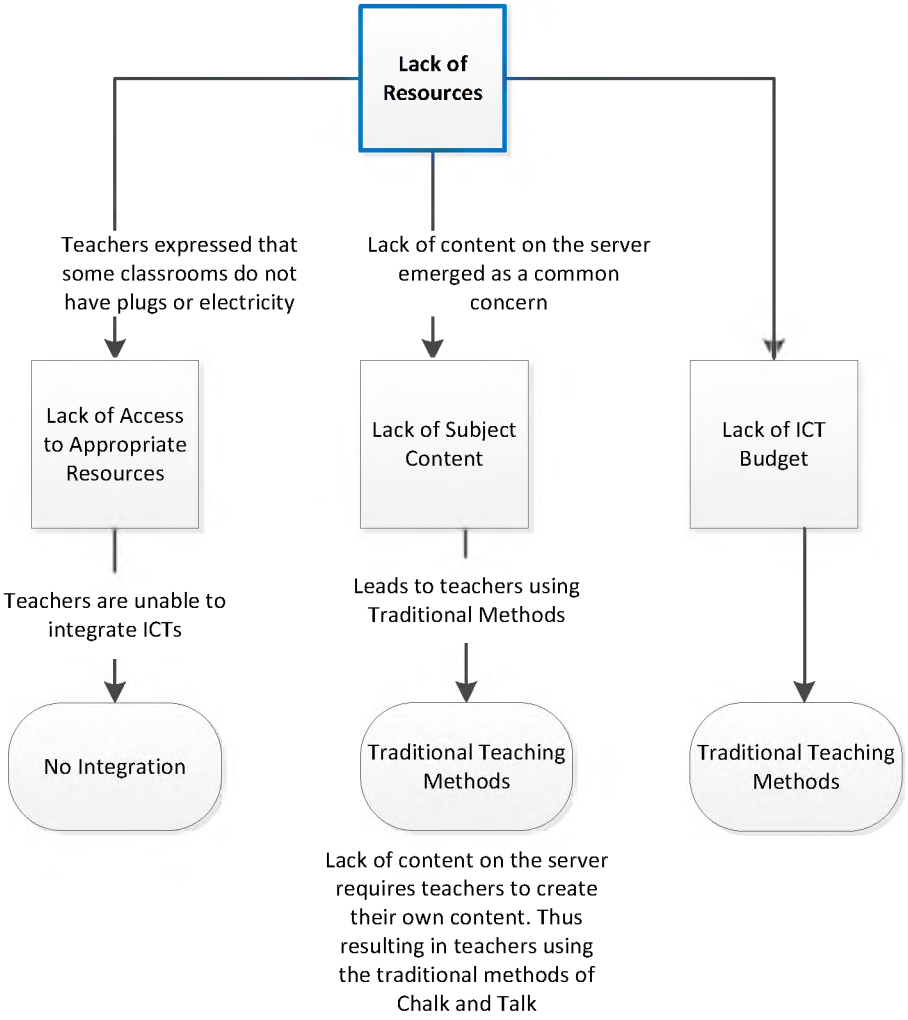

Figure 6.2 Lack of Resources Thematic Map

The availability of routers would allow teachers and learners to connect to the internet and possibly encourage learners to search for their own content and become active knowledge seekers. In addition to the lack of routers, Participant A also mentioned the lack of cables to connect to the projector. Participant B provided an example of a case where she attempted to share an experiment with her class but failed to do so because she was unable to project the lesson.

> *"We do not have a budget to buy these cables to connect to the project … so even if you download something you … put it on the desktop so you can project in class." [Participant A]*

> *"I googled an experiment but it did not work because I could not project the lesson." [Participant B]*

Lack of these resources has an impact on the teacher's decision to use ICTs in the classroom. It is clearly evident that the lack of these resources frustrates and demotivates the teachers. Even though first-order barriers can be easily removed once finances have been provided, it is important to remember that the context of the school and the fact that the finances are not readily available at the school. The following theme discusses the lack of finances.

6.5.1.2 Lack of an ICT Budget

Data indicates that the lack of access to appropriate resources is caused by the lack of an ICT budget at the school. During the interview, Participant A spoke about the lack of financial provision for the ICT committee; the participant highlighted that there was no ICT budget allocated for ICT resources:

> *"The challenge ... the unavailability of a budget, we do not have a budget as ICT. We do not have a budget to purchase cables to connect to the projector..." [Participant A]*

As the participant continued to elaborate I could sense that she was unhappy about the lack of transparency about finances within the school and the fact that they were told that no budget would be made available to them even though the headmaster knew what ICT resources were needed. This then emphasised the importance of the headmaster's role, which will be discussed Figure 6.4.

Participant D highlighted the impact that the lack of an ICT budget had on the learners and parents. The participant mentioned that the school would be forced to transfer all ICT costs to the parents. By this the participant meant that the school might have to charge an extra fee for tablet use. This fee is meant for breakages and any repairing the tablet might need. This might serve as a challenge considering the context and that most parents might not be able to afford to pay the fee. Most people in rural areas depend on social grants, agricultural productivity and remittance from families as the main source of income (National Treasury, 2011; World Bank, 2014). This might also affect the sustainability of the project.

> *"The agreement was that we have our own way of dealing with breakages . . . we were planning to charge a certain fee for tablet use and if the learner does not damage the tablet they get refunded."[Participant D]*

Without a doubt the use of tablets at the school has brought extra expenses, expenses that the school needs to cater for. Routers, cables, fixing of broken tablets etc. are essential first-order barriers that need to be dealt with in order to ensure ICT use and integration.

6.5.1.3 Lack of Subject Content

One of the more prominent sub-themes, 'Lack of content' refers to the subject content found on the server at the school. The participants expressed their complaints over the amount of content available for their subjects. Participant C mentioned that there was not enough content for her subject:

> *"Content for Xhosa is not fully loaded, some of the things are there and some things are missing." [Participant C]*

Similarly, Participant A also mentioned that there is plenty of information for Mathematics and Science, while teachers for the other subjects need to create their own content:

> *"Science and Mathematics people have most content on the tablet and I have to upload my content." [Participant A]*

Other participants were in agreement with the lack of content for some subjects. They mentioned that they needed to create their own content as they could not rely on the tablet only. Participant A mentioned that she used her own data to search for information and additional tools that she could use to improve her lessons. However, not all teachers are able to do this due to the added expense:

> *"... because I teach language and I am not fluent in English, I need to go online and look at different analysis..." [Participant A]*

According to the participants, lack of content for some subjects leads to limited use. This was evident as some teachers mentioned that teaching had changed for Mathematics and Science and not for other subjects. Participant F highlighted that lack of content was demotivating and limited ICT use:

> *"Another demotivation is that there is no content for some teachers as a result you find that some teachers see it as a device to take photos and videos because there is not much available." [Participant F]*

However, on the other hand Participant E, who was the technical consultant, stated that content could not be seen as a barrier, especially because teachers should know how to get content. The participant mentioned that there were some teachers who asked for assistance for obtaining content while others did not. The participant explained that the main reason for not using the

tablet was not lack of content but lack of passion and zeal for ICT use, which will be discussed later.

> *"Some teachers do not use ICTs because of content, this is not the main reason because they know how to get content, some teachers come to me and tell me that they want certain things and I go search for it... Main reason for not using ICTs, I think is passion." [Participant E].*

From the data, it was evident that some teachers would rather not use the tablets and would prefer to stick to traditional methods (textbook) due to the lack of content.

6.5.2 Teacher Training

Another main theme that emerged from the data was **teacher training**. Literature also highlighted teacher training as one of the most cited barriers to integration, as discussed in Chapter 2. Hew and Brush (2007) and Eteokleous (2008) explained the importance of teacher training and the negative result from the lack thereof. The authors stated that inadequate teacher training produces teachers who have limited ICT skills and who lack confidence in teaching with ICTs. As a result, they set ICTs aside for special occasions and hardly use them. Thus Ertmer (1999) emphasised the importance of providing teachers with multiple types of training where the focus was on both technology and pedagogy. ICT4RED provided training for teachers on strategies to use in the classroom. The training was not only on how to use ICTs but also focused on how to use ICTs in the classroom to teach, as discussed in Chapter 5. Participants mentioned that the training was conducted in an interactive manner, where they were encouraged to participate. Furthermore, the participants mentioned that the ICT4RED training was different from other types of training.

Participant B, who had experience in ICT use and had attended past training on ICTs, mentioned that initially she did not understand why training was important but as the training went on she was equipped with strategies to use in the classroom.

> *"Firstly I thought why should we train for tablets because it's just like a phone but as training went on I saw that there is more to the tablet, for instance we were taught*

strategies on how to use it for teaching and how to organise learners because sometimes learners can be unruly." [Participant B]

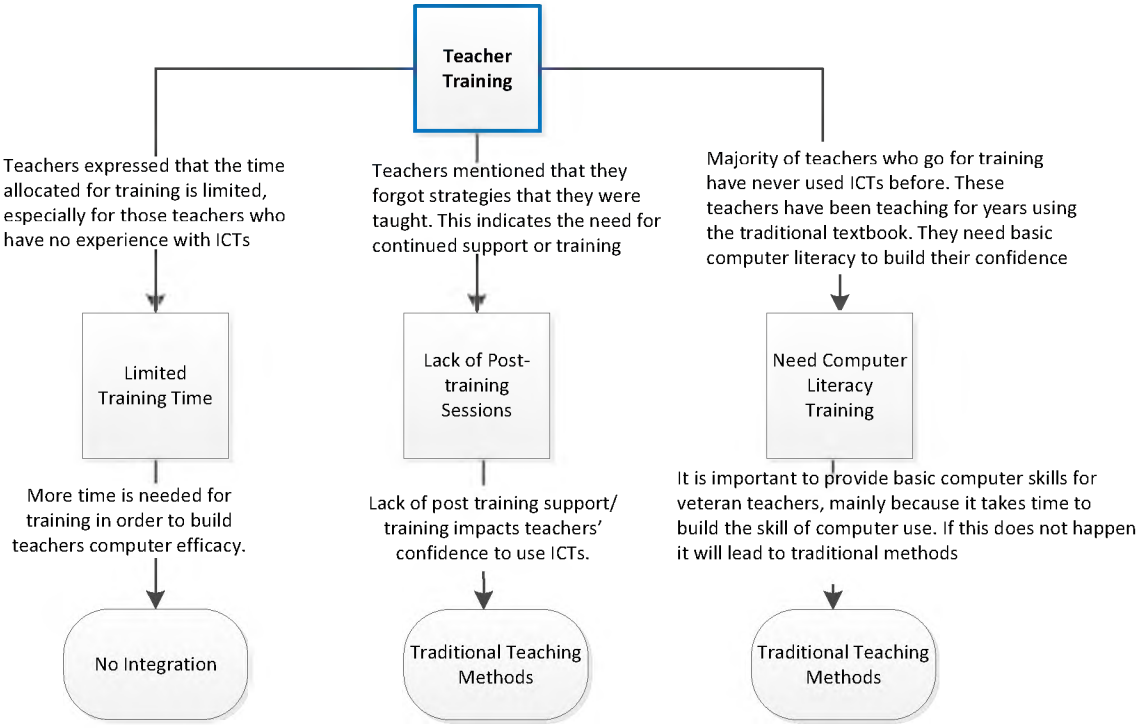

Figure 6.3 Lack of Training Thematic Map

Participant C, who had no experience with ICTs and no previous training, also mentioned that before the training she had no idea how she could use ICTs in her classroom but the training had motivated her to use the tablets and has increased her confidence:

"Training sparked my enthusiasm to use ICTs. Before training I was not confident to try to use ICTs in the classroom … but after training I am a lot confident." [Participant C]

Other participants also mentioned that the training had not only enriched them professionally but it had also played a positive impact on their personal lives. However, sub-themes such as limited time, no post-training sessions and the need for broad training emerged as some of the concerns held by the teachers.

6.5.2.1 Limited Time for Training

Training took place every three weeks for three hours after school. During the training the teachers covered a strategy, learned about a topic and gained technology skills. Once training was complete the teachers had three weeks to apply what they had learnt before the next

training session (ICT4RED, 2014). Various participants expressed that the time allocated for training was limited, especially for those teachers who had no experience with ICTs. Participant A, who was a project assessor and a teacher, highlighted the following:

> *"The training is good and the strategies are good... but the challenge is that the training time is limited. People have only a few hours for training once a month. You talk about Jigsaw then you go, you get to the school to assess and you find that the teachers are clueless." [Participant A]*

Participant C who was Xhosa, similar to Participant A, mentioned the need for more training time. The participant emphasised the fact that more time is needed, especially considering her age and the fact that she had no experience with using ICTs and no previous training:

> *"With training we needed more time, especially with technology. At this age it's not easy for me to even use my phone." [Participant C]*

Other participants mentioned that they had forgotten some of the strategies taught and even though training helped them overcome their fears and increased their eagerness, integration was still a challenge. Thus Participant F mentioned the importance of continued training:

> *"People were initially fearful of ICTs since it was the first experience and thinking that it would be difficult. ... I hope that the training can be an ongoing thing ... sometimes as rural teachers we forget we tend to go back to previous way of teaching ... I wish there could be continuous training refresher course or training. Where we continually are reminded of what we learnt." [Participant F]*

Participants F's comment on continued training brought about a discussion on post-training that might be needed because teachers forget strategies and were more likely to revert to the traditional method of doing things.

6.5.2.2 No Post-Training Session

As mentioned above, the teachers expressed the need for increased training time and possibly continuous training. Participant A expressed that some teachers were assisted by their colleagues during the training and thus they failed to implement the strategies in their own classrooms because they did not know how to use the tablet independently. As a result, when these teachers were assessed, the assessors ended up training them on strategies rather than assessing progress. Without a doubt there was a need for post-training sessions.

"There is a need for the teacher to still be supported after training because some of them were helped by their colleagues in order to complete tasks so they still do not know and are clueless. ... You will get the badge and the tablet but you will not know." [Participant A]

Participant F expressed the same concern and, when asked what he would change about the ICT4RED project, the participant explained that he would not change anything with the training. He would rather increase monitoring and ensure assistance for the teachers, mainly because people cannot be given a workshop and left alone. The participant continued to express that there was a need for continued training because teachers forget.

"I would not change anything in the training but I would add that there must be monitoring. ... People cannot be given a workshop and left alone." [Participant F]

"I hope that the training can be an ongoing thing meaning ... sometimes as rural teachers we forget we tend to go back to previous way of teaching ... I wish there could be continuous training refresher course or training." [Participant F]

Participant C also mentioned the above claiming that as teachers they forget some of the work they covered in training mainly because computer use is a skill that needs to be developed over time. This clearly indicated the need for continued support for the teachers even after training. Continued support can be in the form of training for a week or two as suggested by Participant E, who was the technical consultant:

"I have forgotten because using a computer is a skill and if you do not use it for some time you just forget it." [Participant E]

Participant A also emphasised the importance of post-training support. Participant A's experience as an assessor and visiting the schools had given her the opportunity to observe teachers from various schools, and the participant emphasised the fact that some teachers who were helped by their colleagues during training lacked confidence in their ability to use ICTs in the classroom. Even though they received the badges they did not use the ICTs. Hence, continued support for the teachers was important because they need to build the skill and confidence to use the ICTs:

"There is a need for the teacher to still be supported because some of them were helped by their colleagues in order to complete tasks so they still do not know and are clueless.

And to instill knowledge you need to have a better understanding of something to install confidence and you will be confident." [Participant A.]

6.5.2.3 Computer Literacy Training

Training offered was for all teachers despite subject expertise or level of ICT use. The training focused on equipping the teachers with teaching strategies and technology skills (ICT4RED, 2013). However, it was important to note that the majority of the teachers who go for training were teachers who had never used ICTs before. These were teachers who had been teaching for years using the traditional textbook. As a result, these teachers often struggled with using the tablets, hence Participant B stated that a basic computer literacy workshop would be useful in assisting those teachers:

"There are old teachers sometimes they ask how to do certain things because their education never included ICTs so they still need that help. Basic computer skills would be useful for the old teachers especially." [Participant B]

Participant A also mentioned that it was essential that teachers had basic computer literacy as this would also assist them in content creation. Teachers know how to use the applications and access the server, but some are unable to use other sources for information:

"... a computer background plays a part because you have to create your own content and it's more work for the teacher." [Participant A]

"The teachers have to use the tablet but when you talk about research and how to create their own content, it's a challenge." [Participant A]

The technical consultant also emphasised the importance of basic computer skills for veteran teachers, mainly because it takes time to build the skill of computer use:

"Basic Computer classes for the teachers, they need it and if we could have the unit in a quarterly basis where they come in for a week or two and go and evaluate the teachers because these things take time." [Participant E]

In addition to the computer literacy workshop, some participants also mentioned that the training should be subject-specific for teachers with no ICT experience. Subject-specific training would equip the teachers with the skills they need and would make subject preparation easier. The participants explained that it can be time consuming and demotivating to prepare

for the lessons. It required the teacher to be creative. Hence Participant F stated that they need assistance within the classroom:

> *"If I can have an ICT specialist who will tell me what to do. ... I need guidance on what to do ... we need a specialist to give advice and to assist." [Participant F]*

The participants suggested subject-specific training for veteran teachers in particular to assist them with lesson preparation and to increase their confidence. Lack of support is another major theme that emerged from the data. As mentioned by Participant F and Participant A, there was a need for continued support and assistance for the teachers. Lack of support in the classroom, and lack of support from school leadership and the Department of Education emerged as sub-themes within lack of support. Teachers expressed that the introduction of ICTs in the classroom had increased the work that the teachers had to do and had brought challenges in the classroom.

6.5.3 Lack of Support

Lack of support also emerged as an overarching theme. According to Ertmer, et al. (2012), there are different types of support needed to ensure effective integration. These include administrative, technological, professional and peer support. Teachers need support to deal with different technologies and technical difficulties.

Lack of support in schools hinders ICT integration. The following types of required support emerged from interviews: support within the classroom, support from school leadership and support from DoE.

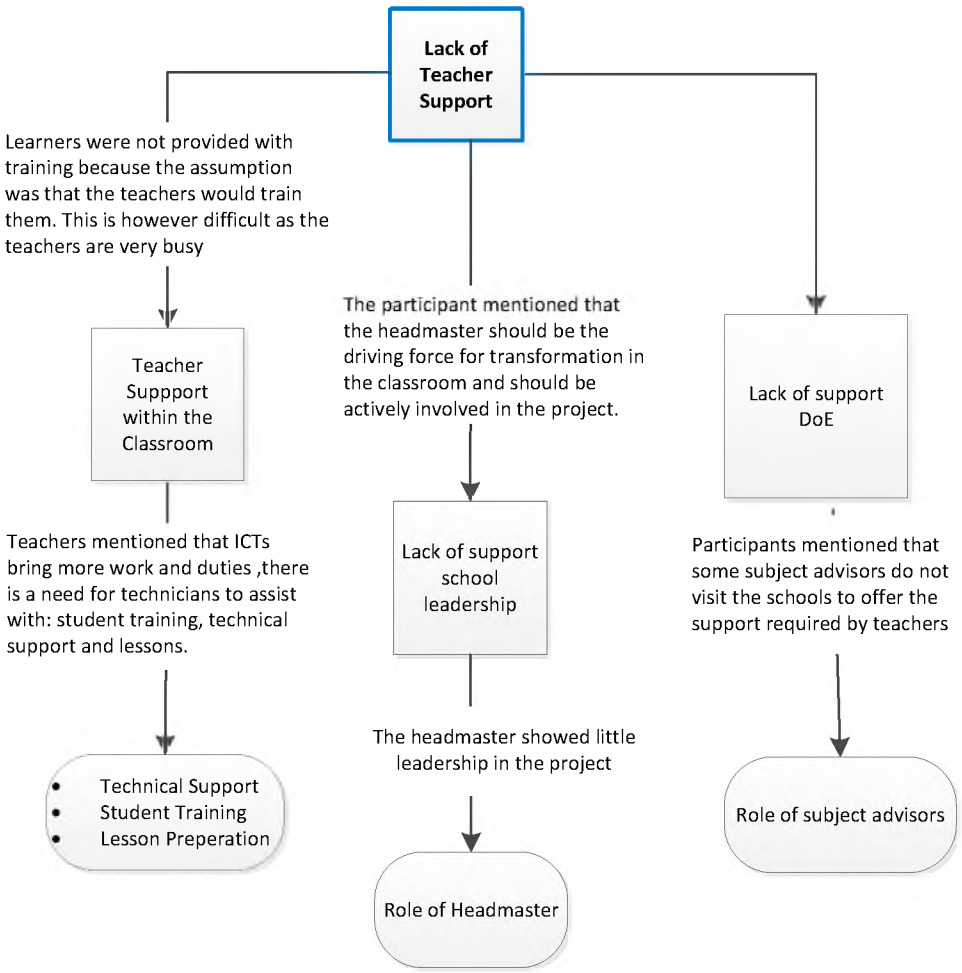

Figure 6.4 Lack of Support Thematic Map

6.5.3.1 Teacher Support within the Classroom

Participant E, who was the technical consultant at the school, highlighted the importance of training the learners. The participant mentioned that, even though the learners were exposed to phones, they did not use touch screens, thus it was essential that they received training on how to use the tablet:

> *"I would also ensure that the learners are trained a bit before we introduce anything, they should have some advanced training before you introduce it to them, and you cannot just introduce the tablet today and expect them to use the tablet, some of them are not using phones, even though some of them do use phones they are not touch screen." [Participant E]*

The learners were not provided with training because the assumption was that the teachers would train them. This was, however, difficult as the teachers themselves were very busy and were overloaded with work. Participant E elaborated on this:

> *"Teachers are meant to train their own learners because they have received training.... One thing I have noticed is that the teachers themselves are overloaded." [Participant E]*

The participants also mentioned that tablet use was predominantly in Grade 12, meaning that the lower grades were not exposed to the tablets and ICTs. This served as a disadvantage because the teachers needed to train the lower grades when they got to Grade 12. Participant D mentioned that it was no surprise that one would find some learners within the school who were unable to use the tablets, even though they were in Grade 12:

> *"It is not surprising to call a learner and to ask them to log onto Wi-Fi and they fail. Most of the focus has been on Grade 12 teaching them how to use the server and access the content from the server but the other lower grades it is a challenge." [Participant D].*

The participant continued to explain that ICTs brought more work and duties for the teachers. The teachers were overloaded and overworked and they did not only have to train the learners. Participant D explained that the department promised to hire technicians to train the learners:

> *"You see technology is bringing extra work for the teachers, extra duties to teachers. ... training is for the teacher and the teachers are responsible in ensuring that the learners know how to use the tablets. ... I think they are in line to find technicians to work with the learners unlike going to the teachers because teachers are normally busy." [Participant D]*

Participant F emphasised the importance of technicians within the school. Participant F was an Economics teacher with twelve years' experience in teaching. The participant mentioned that it would be of great assistance if there could be a designated technician at the school dedicated to helping teachers. The participant claimed it was daunting to ask other teachers for help, especially those part of the ICT committee, because these teachers were also busy:

> *"It was said that there would be a person here at the school dedicated to helping us if you forget something. ... Because it's a daunting task if you forget you will go to*

Participant E. and you go to him and you will find that he is not there or that he is busy. Because Participant E is the one in charge of ICT, so he is a teacher we cannot load him with work." [Participant F]

The participant also explained that the technicians should assist in preparing the classroom for the lesson and work with the teacher to prepare lessons to use ICTs. The participant also stated that the technician at the school would serve as a factor of encouragement to use ICTs. Setting up to use the ICTs could be a daunting task and could demotivate the teachers from using the ICTs:

"The most important part is that if we could be helped when going to class, someone who will assist us with setting up those machines when we're going to class because that is very discouraging because it takes time. Because before you go to class that person would already be there setting up because classes are changing so that encourages you that you go to the class, you just press there and speak to the kids and thereafter interaction." [Participant F]

6.5.3.2 School Leadership

The literature emphasises the importance of supportive leadership that steers the project. Headmasters play an important role in ensuring the acceptance of ICTs. They are responsible for steering the team and creating an environment where ICTs can be used (Flanagan and Jacobsen, 2003; Hew and Brush, 2007; Eteokleous, 2008). As discussed in Chapter 5, section 5.4, the involvement of the headmaster was very important. In this case the participants mentioned the headmaster showed little support and was very passive. Participant A spoke passionately about the importance of the headmaster's role. The participant mentioned that the headmaster should be the driving force for transformation in the classroom and should be actively involved in the project. However, that was not the case at the school. The headmaster, according to participant A was very passive:

"... the headmaster should play a role to assist the ICT committee. ... I feel that he should visit the classes to see if teachers are doing this but even him he is not using any ICT." [Participant A]

During my visit I also observed that the headmaster was not very involved. I was not sure if this was because he was busy but on both field trips we did not interact with him or have the

opportunity to get his opinion. The headmaster directed us to the ICT committee, which was made up of Participants A, D, E and F.

6.5.3.3 Department of Education

In Chapter 5, section 5.5 clearly stated that subject advisors and district officials were trained on tablet use. The workshop for the subject advisors and district officials focused on creating buy-in and change management, and on how to manage the technology in the school. The subject advisors were trained so that they could assist teachers. However, the participants mentioned that the subject advisors rarely visited the schools:

> *"The case here is that I have been working in this district for 6 years but I have had a visit from my advisor 4 times in the 6 years, they do not come to our schools." [Participant A]*

The participants also mentioned that the subject advisors and individuals within the department were discouraging as they were computer illiterate even though their jobs entailed assisting schools with ICTs. Participant A continued to explain that some advisors and eLearning specialists did not know how to use ICTs:

> *"... they were here, discouraging because they themselves do not know. They just came here took tablets and left." [Participant F]*

> *"... some of these advisors do not even know how to download software, some eLearning coordinators do not even know how to use mouse ... our eLearning specialist needs help. She does not know anything about the 21st century objectives." [Participant A]*

In addition, Participant A mentioned that some subject advisors did not want to visit the schools; they wanted to receive extra payment for their visits:

> *"They want to get paid to visit the schools. Some do not want to be associated with the project but they want the tablets, my subject advisor has never visited me and does not know how I teach." [Participant A]*

6.5.4 Changes in School Environment

Participants also mentioned that the introduction of ICTs had changed the school environment. Participants provided examples of how ICTs had changed student behaviour and how the teachers' role had changed in the classroom. Literature explains that ICT use in the classroom allows teachers to become facilitators and they encourage learners to learn independently.

6.5.4.1 Transformation in the Classroom

Participant A mentioned the importance of changing structure within the classroom in order to ensure integration. This participant explained that the learners cannot be sitting in the traditional manner, facing the front waiting for the teacher to teach; they need to sit in groups or structures that encourage communication and discussion. The participant explained that, as part of the headmaster's role in the school, ensuring change in the classroom should be one of his/her duties.

> *"... if the environment itself is not transformed how are we expecting to see change? One should be mindful of the change that should take place." [Participant A]*

The participant continued to explain that in some cases one teacher will change the classroom setting, tell learners to sit in groups but on returning will find another teacher has changed the classroom setting back to the traditional setting.

6.5.4.2 Transformation in the Teacher's Role

The introduction of tablets in the school has affected how teachers conduct their classes and most importantly it has also affected the teachers' teaching style. According to Maggie Verster (ICT4RED, 2014), the goal of the project was to introduce strategies that would change teacher-centred learning to student-centred learning. This was evident at the school, as the participants referred to how their roles as teachers had changed in the classroom as observed during the second field visit (refer to Chapter 5, Section 5.4).

The literature discusses teacher pedagogical beliefs and how these beliefs affect the teachers' use of ICTs in the classroom. Teachers with traditional pedagogical beliefs (instructivism) as a teaching practice provide information to the learners. They become the main source of information and the main transmitter of information in the classroom, whereas constructivist pedagogical beliefs (constructivism) encourage learners to learn independently and to tackle complex and difficult authentic problems (Pelgrum, 2001; Wilson-Strydom and Thomson,

2005; Chen, 2008; Baeten, et al., 2010; Naicker, 2010). The introduction of tablets at the school has encouraged teachers to move away from traditional pedagogical beliefs.

The participants mentioned strategies such as the JIGSAW method, which encourages learners to work in groups. These strategies require the teacher to be a facilitator rather than the main source of information. Participant D provided an example of how he used JIGSAW in his classroom:

> *"JIGSAW is a teaching method where I teach one question in one group and I split the groups and those learners will then explain to each the other in their new groups. Sometimes they would record what they learnt and show calculations they have done." [Participant D]*

Participant D demonstrated the JIGSAW method during the field trip (refer to Chapter 5). JIGSAW is an example of a strategy that encourages independent learning. Participant F also highlighted this change of the teachers' role; the participant explained that the introduction of the tablets allows learners to do work at home and has had an impact on student behaviour.

6.5.4.3 Changes in Student Behaviour

As mentioned, ICTs offer the potential to advance student knowledge and skills. They foster co-operative learning and encourage independent learning amongst the learners (Chapter 3, Section 3.2). According to the participants, student behaviour has changed since the introduction of the tablets. Learners have become more involved in the classroom and independent:

> *"The learners are more involved sometimes when you stand in front of them and you teach some learners will never participate." [Participant D]*

In addition, Participant C highlighted changes in behaviour. The participant explained that in the past you would find learners making a noise in the classroom when the teacher was not there. Now they were constantly busy on their tablets.

> *"... behaviour of learners has changed, because when the teacher is not there they use to make a lot of noise but now you will find them busy." [Participant C]*

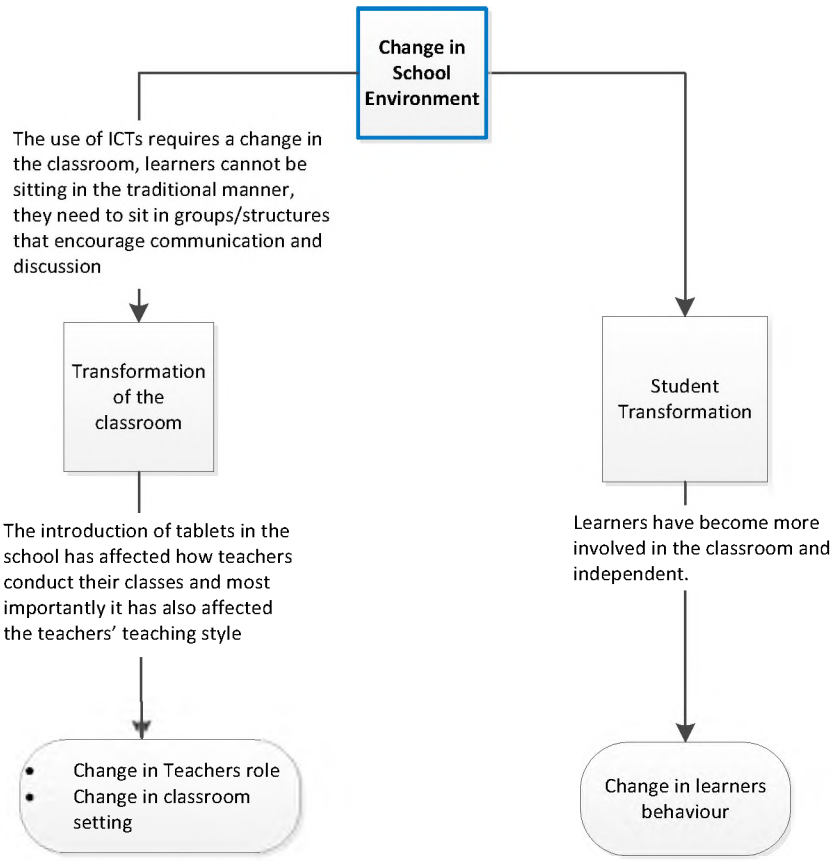

Figure 6.5 Changes in School Environment Thematic Map

There were changes in confidence noted: Participant A and Participant F both mentioned that the learners had become more confident. Their confidence also increased their drive and motivation. The participants further mentioned that the integration of the tablets has afforded the learners the opportunity to compete with learners in urban areas:

> *"... learners have confidence because now they can see that many things are being provided and that leads to them having a drive and eagerness to learn." [Participant F]*

> *"The learners are confident because they have tablets. Because maybe people from urban areas and rural areas were treated differently but now it's different." [Participant B]*

Participant F also mentioned that the learners were confident and eager to learn. Even though one cannot measure the actual performance of the learners, as there are many factors that affect learner performance besides the availability of the tablets, the tablets have definitely had an impact:

"Although we do not see actual results the learners have confidence because now they can see that many things are being provided and that leads to them having a drive and eagerness to learn I will not say that they are performing ... but they are eager." [Participant F]

6.5.5 Teacher Attitude

Teacher attitude is another theme that emerged from the interviews. Literature refers to teacher attitude as a second-order barrier that is intrinsic to the teacher. It is rooted in the teachers' beliefs about teaching and learning (Ertmer, 2005; Eteokleous, 2008; Sang, et al., 2010; Donelly, et al., 2011; Du Plessis and Webb, 2012).

As discussed in the literature, teacher pedagogical beliefs, teaching self-efficacy, computer self-efficacy and attitudes are factors that have an impact on successful integration. These factors are related to the teachers' thinking process rather than the skills they possess. This highlights the importance of not only training the teachers but also of understanding the teachers' thinking processes (Sang, et al., 2010). Various participants mentioned that some teachers did not use ICTs even though all the teachers received training and were provided with support, hence teacher attitude emerged as a major theme.

6.5.5.1 Pedagogical Beliefs

According to Sang, et al. (2010), teacher beliefs about teaching and learning are important factors in determining patterns on ICT use in the classroom. Several studies theorise that teachers with constructivist beliefs (student-centred practices) are associated with high-level use of computers whereas infrequent computer use is associated with traditional pedagogical beliefs (teacher-centred practices) (Ertmer, 2005; Naicker, 2010; Sang, et al., 2010).

According to the participants, moving away from the traditional paradigm was challenging. Most teachers at the school used the textbook and chalk board to teach and the introduction of the tablets required them to shift their paradigms.

"... to change from an old paradigm to a new one is difficult and you know that people are reluctant to change because change is challenging." [Participant F]

The participant continued to explain that the teachers require assistance in order to change their paradigms. The participant also highlighted the fact that his experience and age played a role in the paradigm shift:

"At my age at 40 and now you are telling me I must switch from my traditional ways to this ICT things meaning that sometimes your tablet will sit there for days and will be used maybe for WhatsApp of which this is meant for educational purposes." [Participant F]

Participant C, who is a Xhosa teacher at the school, explained how the introduction of the tablets had shifted her teaching paradigm from teacher-centred to a mixture of both teacher-centred and student-centred practices. The teacher explained that she incorporated ICTs into her classroom and encouraged the learners to work independently.

"... my teaching strategies have changed, initially my approach was teacher-centred but now it is a mixture of teacher and student-centred." [Participant C]

During the interviews and the observations, the participants provided various examples of how their teaching strategies had changed. These changes in their beliefs had affected their overall attitude and encouraged integration.

6.5.5.2 Computer Efficacy

According to Sang, et al. (2010), computer efficacy refers to one's belief and perceptions of one's capability to use computers in the classroom. Teachers with high computer-efficacy tend to use computers more often and experience less computer anxiety, whereas teachers with low computer-efficacy tend to experience frustration and hesitate to use computers (Sang, et al., 2010). Computer-efficacy affects how the teacher feels about computer use. To increase computer efficacy, it is essential to ensure that teachers are provided with training that increases their efficacy. Participants mentioned that some teachers required basic computer literacy in addition to the ICT4RED training in order to increase their confidence and computer efficacy.

"There are old teachers sometimes they ask how to do certain things because their education never included ICTs so they still need that help ... basic computer skills would be useful for the old teachers especially." [Participant B]

In addition to the subject-specific training, participants mentioned that teachers should be afforded the opportunity to use computers, as this would equip them with the ability to use other ICTs. This exposure to the computer would increase their confidence when they were using the tablets:

"Exposure ... they will have confidence and once you have confidence you will be up for a challenge." [Participant A]

6.5.5.3 Personal Drive

Within the teacher attitude theme, personal drive emerged as a sub-theme, where participants highlighted that they used ICTs because they were passionate about ICTs. Literature highlights that teachers are the ones who decide whether they will use ICTs in the classroom or not. Hence, it is essential to ensure that the teachers have the correct attitude towards ICT use in the classroom. Ertmer, et al. (2012) suggested that the best way to encourage teachers to integrate ICTs was through increasing the knowledge and skills of the teachers, which in turn could change their attitudes. However, in addition to skills and knowledge, data collection highlighted personal drive/passion.

Participant D mentioned that some people are lagging behind regarding ICT use in the classroom mainly because some teachers did not have passion and they did not use ICTs outside the classroom:

"Some people who are lagging mainly because technology you need to be passionate in it, because you can learn how to use a computer today but if you take some time without using it you lose everything so people sometimes are not having time with the technology." [Participant D]

Similarly, Participant E, who is the technical consultant, stated that teachers lack passion and it is a personal decision that they need to make. The teachers need to decide to move towards ICT use:

"This might sound weird but I think it's passion, it's passion because it's a personal thing because you should have that personal zeal and say look I need to change because this is what is happening let me follow the flow, everybody is going IT let me also convert." [Participant E]

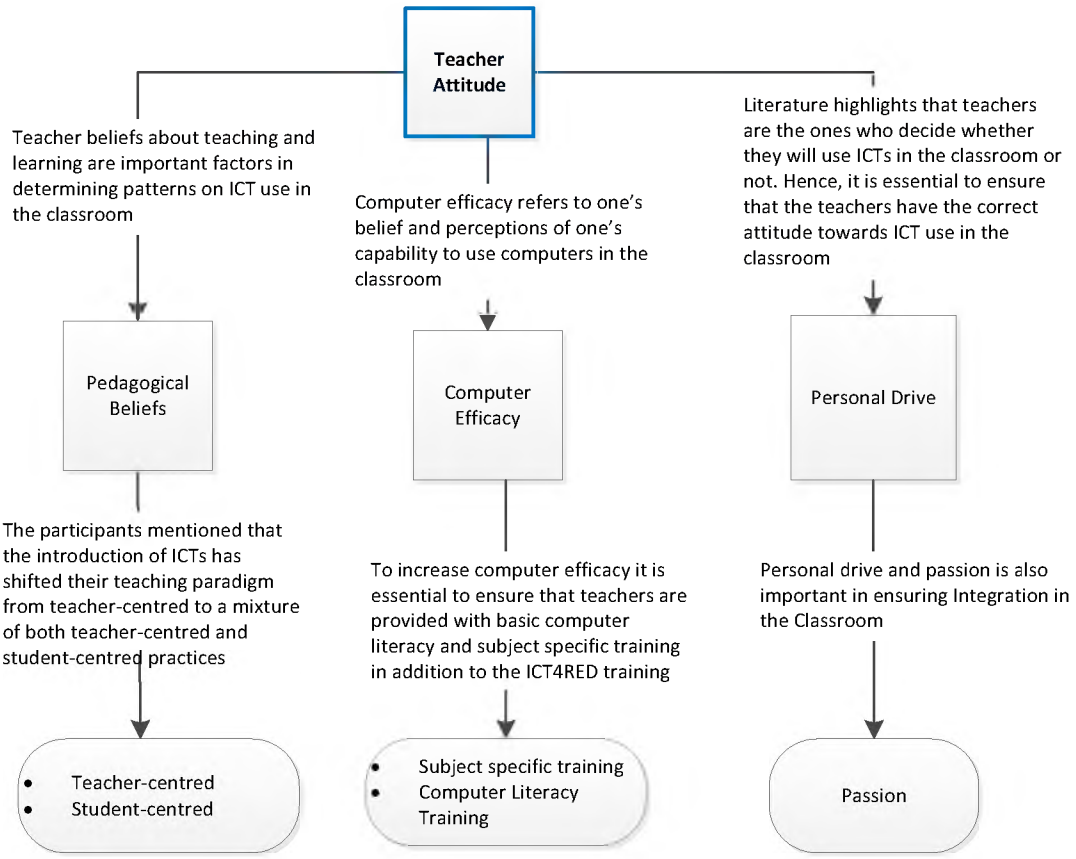

Figure 6.6 Teacher Attitude Thematic Map

Participant E continued to explain what he meant by passion. The participant provided an example of how Participant C, who had no ICT experience, continually integrated the tablets into her lessons, and how the participant explored ways to use the tablets to deal with challenges such as textbook shortage. The participant explained that in some teachers there was no passion:

> *"For example the Xhosa teacher, I get her passion ... she was telling me that she does not have enough textbooks and wanted to take pictures of the pages and this led to a discussion of buying a digital copy of the book. For her you see her passion. But the rest the passion is not there and that requires work." [Participant E]*

Even though the other participants highlighted the importance of intrinsic passion, Participant D, who is an Economics and English teacher, claimed that passion could also be encouraged. The participant mentioned that continued assistance within the classroom would assist in fueling passion. The participant claimed that as teachers they "dragged their feet" at times,

mainly because it was easier to take the book to the classroom and teach in the way they have been doing for years:

> *"Passion does not come from nowhere it comes from somewhere and that is the problem we are having. Sometimes we are dragging feet, even me I am dragging my feet, I know I have been teaching economics for sometimes I just take the book to the class with my chalk and I know what I am going to do because I have been doing this for some years. ... We need these ICT specialists to assist..." [Participant F]*

In addition to passion, Participant D also mentioned that he used ICTs for personal reasons. The participant mentioned that he owned a business that involved ICTs, hence his interest in using tablets. This participant spoke about how the project had provided him with opportunities to link up with other teachers:

> *"I have a business in ICT, I also help people ... I think that ICT also has helped me link with people on the outside, like when I went for the conference, I had the opportunity to link with people on social networks and I am always updated on how people use ICTs in the classroom and especially on twitter people share and they share information." [Participant D]*

Having developed these themes, the researcher applied some of the principles examined in Chapter 5 to assist in understanding the data and the context. Firstly, the principle of contextualisation was applied (see Chapter 4, Section 4.9), which involved critical reflection on the social and historical background of the research setting, where the researcher took into account the entire background environment of the research. Additionally, the principle of abstraction and generalisation (see Chapter 4, Section 4.9) was applied. Based on the extracted themes (**lack of resources, teacher training, lack of support, changes in school environment** as well as **teacher attitudes**), literature and observations, the researcher summarised the important factors that influence ICT integration in a conceptual framework. The following section will elaborate on the framework.

6.6 Proposed Framework for ICT Integration

As mentioned in Chapter 5, considering that the researcher aimed to develop a deep understanding of the context and the literature, a combination of deductive and inductive reasoning (Schultze, 2000) was applied. Initially deductive reasoning was adopted, where the researcher went into the research context for data collection using the TPACK framework as a

conceptual framework obtained from the literature. The framework was used as a lens to collect information with regard to skills required by teachers to integrate ICTs (Burney, 2008). In addition to the use of deductive reasoning, the researcher used inductive reasoning. Inductive reasoning assisted the researcher in generating authentic context specific data. According to Hayes, Heit and Swendsen (2010), inductive reasoning allows the researcher to use existing information from observations and interviews to inform literature. This provided the researcher with a richer understanding of the context. As mentioned TPACK emerged as a conceptual framework through the use of deductive reasoning; however TPACK had its limitations.

TPACK can be viewed as a conceptual lens through which educational technology can be viewed. According to Koehler, Shin and Mishra (2012), the framework draws attention to specific technology and pedagogy issues and ignores irrelevant issues. However, the framework requires further work. Although it (TPACK) provides insight on the kind of skills that the teachers need to ensure integration, literature highlights the importance of looking at first and second-order barriers as well as context. TPACK encourages training that goes beyond simple computer skills such as word-processing. However, factors such as teacher beliefs and context are not discussed in the framework, even though they are relevant to educational technology.

Hence the researcher used inductive reasoning to account for contextual data as illustrated in the final conceptual framework presented below. This conceptual framework is based on literature (TPACK), observations and themes from the interviews. It creates relationships between the main factors and considerations that impact ICT integration, i.e. teacher pedagogical beliefs, barriers to integration, teacher skills (TPACK) and context. The framework aims to serve as a summary of all the important factors that have an impact on ICT integration in marginalised schools. It proposes how ICT integration in education could be considered from different perspectives.

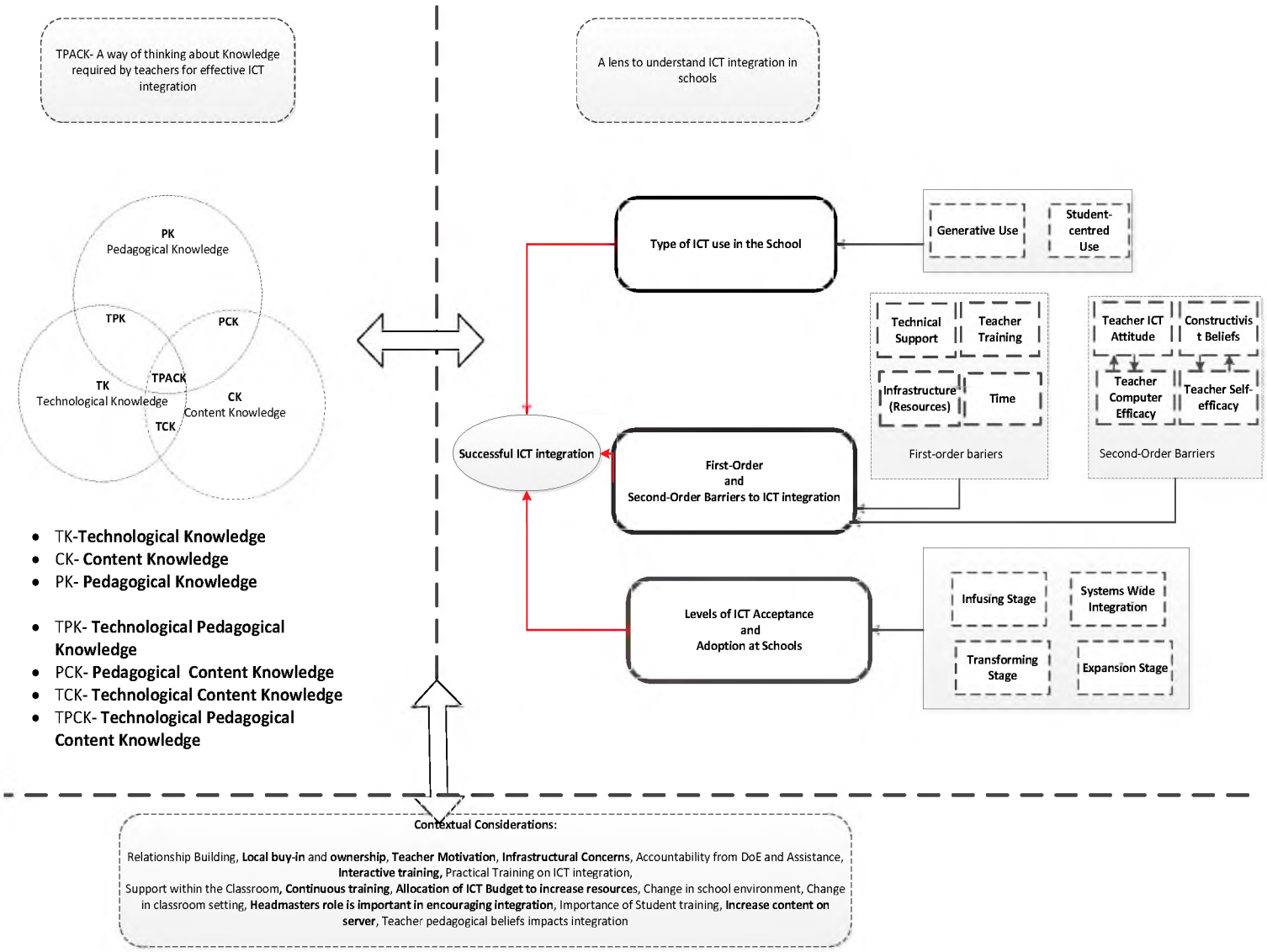

Figure 6.7 Proposed Conceptual Framework

The framework starts off by providing a lens to understand ICT integration by looking at the various types of knowledge required by teachers in order to integrate ICTs (TPACK framework). TPACK, as discussed in Chapter 3, focuses on the skills that teachers need for successful ICT integration. Technological Knowledge (TK), Content Knowledge (CK) and Pedagogical Knowledge (PK) are the three main categories highlighted by the framework followed by Technology Pedagogical Knowledge (TPK), Technology Content Knowledge (TCK) and Pedagogical Content Knowledge (PCK).

The TPACK framework emphasises the importance of providing teachers with the technological skills and pedagogical skills to use the provided technology, mainly because the teachers' ability to bring together content knowledge, pedagogy skills, and technology skills greatly affects ICT integration in the classroom (Evoh, 2007; Hennessy, et al., 2010). TPACK encourages training that goes beyond simple computer skills such as word-processing. It focuses on making sure that teachers are knowledgeable when using computers to prepare their lessons (Jones, 2004, cited in Naicker, 2010). Hence it has been highlighted as an important factor in the framework.

In addition to TPACK, the author introduces a lens for looking at integration. As discussed, integration is a complex and challenging process for schools especially those with limited previous experience in ICT use. There are various factors that have an impact on integration. Based on themes that emerged from literature and the interviews, the researcher identified the following as important factors to consider in ensuring successful integration. Firstly, first-order barriers that emerged were lack of resources, lack of time, and lack of teacher support. In ensuring integration, it is important that these first-order barriers are eliminated. In addition to first-order barriers, second-order barriers were also identified by the researcher as important.

Early models of training and of education assumed that when first-order barriers are eliminated ICT integration would follow. However, second-order barriers also play an important role in ICT integration; hence the framework indicates that they are also important. Barriers such as teacher self-efficacy and pedagogical beliefs are factors that affect teacher decisions to integrate. Chapter 3, Section 3.4 highlighted the importance of focusing on second-order barriers. The framework also indicates that there is a relationship between first-order and second-order barriers. In addition to the barriers, the researcher also highlighted the importance of acknowledging the phases of ICT adoption that schools go through (see Chapter 2, Section 2.4). The framework indicates that the infusion stage, transforming stage, and expansion stage, as well as systems wide integration, are the stages where schools are most likely to integrate ICTs. It is important to acknowledge the phase or stage of integration.

In addition to barriers, stages of ICT adoption and TPACK, it is important to focus on ICT use. The manner in which teachers use ICTs in their classrooms will determine whether they are integrating ICTs or not. Chapter 2, Section 2.5 defined two types of ICT uses: generative use and representational use. The framework indicates that, in order to ensure successful

integration, teachers need to use ICTs in a generative manner. ICT use is highly linked to teacher pedagogical beliefs (second-order barrier) and training (TPACK).

Furthermore, the literature (Chen, 2008; Liu, 2011) highlights that there are inconsistencies in beliefs and ICT use. These inconsistencies are a result of external factors (e.g. parents), and a lack of understanding of constructivist practices as well as conflicting beliefs (Chapter 3, Section 3.4). These inconsistencies are addressed by contextual considerations, which include the importance of buy-in, practical training to ensure clear understanding of constructivist practices and strategies to ensure integration. These contextual considerations emerged from interviews and observations. They are important as they provide information on the environment and context within which integration needs to occur. As illustrated in the framework, the following contextual factors are important factors that impact ICT integration in the classroom: local buy-in from the headmaster, teachers and district officials; support from the Department of Education; continuous practical training for teachers; and changes in the classroom to accommodate for ICT integration, as well as the headmaster's role. Subject content (Chapter 6, Section 6.5) on the server also had an impact on whether teachers integrated ICTs.

The framework shows that ICT training is not the only factor to affect teachers' decisions to integrate ICTs into the classroom. It summarises aspects that are crucial in integration by considering factors that go beyond training. It highlights the fact that training should equip teachers with strategies that allow them to use ICTs in a generative manner. Lastly, the framework also highlights the contextual considerations obtained from observations and interviews. Context plays an important role in ICT integration mainly because it highlights factors relevant to marginalised rural areas. As indicated by the arrows in the diagram, all of these components are interdependent. Hence it is important to focus on all of these aspects in order to ensure integration where ICTs are interwoven into curriculum.

6.7 Conclusion

This Chapter provided the reader with Braun and Clarke's (2006) phases on how to conduct thematic analysis. Thereafter, the researcher applied these phases to the data collected and extracted emergent themes from the data. Lack of resources, teacher training, lack of support, and changes in school environment, as well as teacher attitudes, were discussed as important themes from interviews. Thematic maps representing the main themes (lack of resources,

teacher training, and lack of support, changes in school environment and teacher attitudes), as well as sub-themes, were provided coupled with in-depth explanations.

These themes that emerged from the interviews and from the observations, in combination with the themes extracted from literature, informed the research and assisted the researcher in developing a conceptual framework. The framework (Figure 6.6.) highlights important factors that affect successful integration. The framework demonstrates relationships between the main theoretical factors and considerations that have an impact on ICT integration in rural schools.

Chapter 7
Findings and Contribution

7.1 Introduction

The aim of this Chapter is to revisit the research questions and illustrate how they have been answered. This Chapter will also present a detailed discussion on the contributions of the study. Thereafter, the researcher will present a set of recommendations for the ICT4RED project. Areas of future research will also be highlighted.

7.2 Summary of Thesis

This thesis addresses the topic of ICT integration in marginalised schools, with a focus on the factors that affect ICT integration in the classroom such as teacher training. The problem outlined in Chapter 1 highlights that ICT integration is not a norm in South African schools. Most schools with access to ICTs focus on teaching *about* ICTs and having ICTs as a separate subject, rather than teaching *through* or *with* ICTs. They do not align ICTs with what is happening in the classroom, even though ICTs can add value to the curriculum by encouraging students to move away from learning by memorisation of facts towards a process of knowledge creation. ICT integration is still not prevalent in South African schools. This thesis therefore explores the factors that hamper integration, with the main focus being teacher training. The thesis consists of six Chapters, namely:

- **Chapter 1**. This introduced the area of research by providing the reader with a background study of the research area. The problem statement and research context were also discussed. Thereafter the researcher discussed the goals of the research, research questions, research methodology and the research strategy. Data collection methods, sources of data and data treatment were also discussed. Lastly the Chapter also discussed ethical clearance issues.

- **Chapter 2** presented the roles and uses of information communication technologies (ICTs) in education. The Chapter began by discussing the emergence of ICT use in the classroom. Thereafter the Chapter explored the term 'integration' using phases of integration presented in the UNESCO (2002) report as well as Toledo's (2005) Five-stage Model for computer technology integration. Thereafter the Chapter introduced integration according to Hokanson and Hooper's (2000) types of integration.

- **Chapter 3** highlighted issues and concerns around the adoption, acceptance and implementation of ICTs in education. First-order barriers and second-order barriers to technology adoption and integration were mentioned. The author also discussed the Technological Pedagogical Content Knowledge (TPACK) framework, which focuses on the knowledge required by teachers for integration.
- **Chapter 4** presented the research methodology adopted for conducting this research. The underlying philosophy, interpretivism, was presented. The Chapter also addressed issues such as research strategies, data collection methods, sources of data and data to be collected. The interview guide, interview questions and field procedures were provided. Furthermore, the Chapter explained thematic analysis and how it was used to analyse the responses of interviewees. Hermeneutic principles were also discussed as well as ethical clearance.

- **Chapter 5** introduced the ICT4RED project as the case study where data would be collected. The Chapter focused on providing the reader with an in-depth understanding of the ICT4RED project by describing various aspects of the project. The TECH4RED initiative was explained, as well as the involvement of CSIR. Contextual information on Cofimvaba was also provided.

- **Chapter 6** detailed the observations made by the researcher from the field visits. It provided an analysis of the observations by presenting themes that emerged from both field visits. Furthermore, the Chapter provided the reader with the steps taken to analyse the data using thematic analysis. It also provided the reader with information concerning the interviewees. However, most importantly this Chapter provided the reader with the thematic analysis results by elaborating on emergent themes from the data. At the end of the Chapter the researcher presented a final conceptual framework based on interviews, observations and literature.

7.3 Research Questions

As mentioned above, this thesis addresses the topic of ICT integration in marginalised schools with a particular focus on the impact of teacher training on integration. Using the ICT4RED project as a case study, the researcher went into the field with the aim of understanding whether training provided for teachers in the project had equipped them with skills to integrate ICTs into the classroom. Furthermore, the researcher aimed to understand the factors that impact ICT integration in marginalised schools. In order to achieve this, the researcher began by

exploring the environment in which the teachers worked. This was through participation observation as well as interviews. Thereafter the researcher focused on understanding teacher perceptions regarding the ICT training they received and their subsequent ability to integrate ICTs into their classrooms, as well as their pedagogical beliefs regarding ICT use in the classroom. Hence, the researcher set out to answer the following primary research question:

"How has the ICT4RED professional teacher training programme had an impact on in-service teachers to integrate ICTs into the classroom?"

Interviews and observations showed that teacher training equipped the teachers with skills on how to integrate ICTs into the classroom. Training observations (see Chapter 5, section 5.3) highlighted that the modules in the training moved beyond simple computer skills. The training prepared the teachers on how to use the tablets in the classroom. Training was carried out in a constructivist manner where teachers were encouraged to learn independently as well as to work collaboratively. The training received by the teachers was conducted in the same manner that the teachers were expected to conduct their lessons. However, participants mentioned that there are other factors that limit their use of ICTs in the classroom. Thus, first-order barriers were highlighted as well as second-order barriers (see Chapter 6, Section 6.3). Continuous teacher training and student training, as well as having an IT specialist at the school, emerged as important factors in ensuring ICT integration. This thesis therefore highlights these factors as important determinants that will influence ICT integration in the classroom.

In order to gain understanding of the primary question I focused on understanding the following sub-questions:

"What are the teachers' perceptions regarding the usefulness and value of ICTs in schools and education?"

This question focused on determining whether teachers understood the importance of ICTs and the benefits attributed to ICT use in education. Based on the interviews and interactions with the participants, it became evident that teachers at Arthur Mfebe saw the importance of ICTs and were willing to integrate them in their classrooms. Additionally, some participants mentioned that they had observed changes in learner behaviour. According to Participant F, student behaviour had changed since the introduction of the tablets. Students have become more involved in the classroom and more independent and their confidence and motivation had increased:

"... students have confidence because now they can see that many things are being provided and that leads to them having a drive and eagerness to learn." [F]

As a result, this motivated teachers to integrate ICTs into their lessons. However, besides the value and benefits of ICTs in teaching, the participants also mentioned barriers that affected their ability to integrate ICTs, mainly first-orders barriers such as lack of resources, lack of continuous training and lack of continuous support. Lack of resources, as discussed in Chapter 6, Figure 6.5.1, highlighted that some classrooms do not have electricity or plugs, and the lack of a budget to buy routers and cables for projectors limits the level of integration. On the other hand, lack of continuous training results in teachers who use ICTs in a limited manner because they have forgotten certain strategies. It is for this reason that the participants highlighted the importance of an IT specialist at the school, who would be dedicated to assisting teachers with integration.

The answer to this question illustrates that teachers who see the value of ICTs in education are most likely to integrate them. It is therefore crucial that there is continued support within the schools to ensure that teachers do not revert to traditional methods of teaching and learning.

"How do teacher perceptions and beliefs concerning ICT integration in the classroom affect their decision to integrate ICTs?"

In addition to understanding how the teachers feel about ICT use in the classroom, it was important that I focused on teacher perceptions regarding ICT integration. Perceptions and beliefs about integration are second-order barriers that are essential in determining whether a teacher will choose to integrate or not (Chapter 2).

The majority of the participants mentioned that they were interested in using ICTs in the classroom. They saw the value and usefulness of ICTs in the classroom. They believed in the importance of introducing ICTs in education. Participant B in particular mentioned that she was always interested in using ICTs in her classroom, however, she did not know how to go about it. Furthermore, some participants who had received previous ICT training mentioned that they were unaware as to how they would integrate ICTs as the training that they received focused on strategies to use ICTs in a representational manner rather than on how to integrate ICTs into the classroom. This therefore reiterated the importance of ICT training that focuses on strategies to use in the classroom in order to integrate ICTs. Training such as the ICT4RED training will address the issue of representational use of ICTs in schools, where ICTs are

frequently used without any relation to curriculum. As discussed in literature, most schools use ICTs in a limited manner, where the focus is on "learning about the computer" or acquiring technical skills rather than integrating ICTs into the classroom. This research thus confirms findings from the literature (Ertmer, 1999; Mueller, et al., 2008; Goktas , et al., 2012).

Upon establishing the premise that teachers at the research school understood the importance of ICTs in the classroom and that the training received provided them with strategies to use in the classroom, the next step was to focus on teacher pedagogical beliefs. According to Hermans, et al. (2008), teachers with teacher-centred pedagogical beliefs are most likely not to integrate ICTs, whereas teachers with student-centred pedagogical beliefs are most likely to integrate them. Based on observation it became evident that the teachers taught in an instructivist teacher-centred manner mainly because it was the norm at the school. Even though some participants showed that their beliefs are student-centred there was little evidence of constructivism.

Participant B, who was a Xhosa teacher, mentioned that the training and introduction of ICTs shifted her beliefs from instructivism towards constructivism (student-centered learning). This therefore highlighted that teacher pedagogical beliefs do play a role, but they are influenced by factors such as training on ICT integration and exposure to ICTs. The answers to this question illustrated that beliefs were important, but they can be influenced through appropriate training, training that is practical and that focuses on strategies to integrate as well as exposure to ICTs. From the observations and the interviews, it is evident that the majority of traditional teaching methods are still prevalent, mainly because of the following factors:

- **Time**: the participants explained that it can be time consuming and demotivating to prepare for the lessons. It requires the teacher to be creative. It is for this reason that Participant F mentioned the importance of continuous training and support at the school to assist teachers with lesson planning and ICT integration.

- **Resources**: lack of resources as illustrated in Chapter 6 section 6.5.1 served as a major factor that impacted teacher motivation as well as decision to integrate.

- **Motivation**: participants explained that ICTs bring more work and duties for the teachers and it often can be daunting to set up for a lesson. In order to ensure motivation and increased integration, each school should have IT technicians to assist in preparing

the classroom for the lesson and to help the teachers to prepare lessons that integrate ICTs.

"What are the perceptions of in-service teachers regarding ICT training: has it encouraged and motivated them to integrate ICTs into the classroom?"

Upon determining how teachers felt about ICT and integration, I focused on determining whether they felt that the ICT4RED training equipped them with the necessary skills to integrate ICTs into their classrooms. The majority of the participants agreed that training motivated them to use ICTs; it provided them with the necessary skills to integrate ICTs into the classroom. Participants who had attended previous ICT training and those who had experience in ICTs highlighted the fact that the training did not only focus on how to use ICTs but also provided them with skills on how to use the tablet as a teaching tool. Participant C mentioned that she was not comfortable with using ICTs before training; training definitely played a role in increasing her confidence and motivating her. Another participant mentioned that initially she did not understand why they had to go through training for using tablets. However, after training she realised the importance, mainly because training was not only on how to use the tablet but also covered strategies to use in the classroom when using the tablet.

Even though training motivated the participants, they mentioned that training should be continuous. According to Participant F, continuous training would assist in ensuring that teachers did not go back to their traditional methods. Chapter 6, 'Teacher Training Thematic Map' (Figure 6.5.2), illustrated this and discussed this in depth. In addition to continuous training, the participants also mentioned the importance of having IT technicians at the school, as discussed above. The IT technicians would assist the teachers with lesson planning and ICT integration.

Computer literacy training further emerged as an important motivator of integration especially for teachers who have never used ICTs before. The participants encouraged this training as it would reduce technophobia and boost the confidence of teachers. Furthermore, providing teachers with basic computer literacy would motivate them to search and create their own content.

Some teachers mentioned that other motivators to using ICTs or integration included personal drive and passion for ICTs. Chapter 6, 'Teacher Attitude Thematic Map' (Figure 6.5.5), discussed passion and drive as important factors that influence teachers to integrate ICTs.

Participant D mentioned that some teachers are lagging behind regarding ICT use in the classroom mainly because they did not have passion and they did not use ICTs outside the classroom.

> *"Some people who are lagging mainly because technology you need to be passionate in it, because you can learn how to use a computer today but if you take some time without using it you lose everything so people sometimes are not having time with the technology." [Participant D]*

7.4 Key Contributions

Many contributions made by this study particularly stem from the results of using thematic analysis and interpretivism in order to address the main research question. Using interpretivism enabled me to uncover unique aspects of the context, aspects that are context-specific. The following context-specific findings assisted in understanding the challenges that teachers in rural areas face:

- The first challenge that emerged from the study is the lack of resources (see section 6.5.1). Lack of resources such as electricity is still a challenge in many rural areas in the Eastern Cape (see Chapter 5, section 5.9). Based on the observations at the various schools it became evident that some schools still do not have basic services such as water, sanitation or electricity. Interviews and observations at Arthur Mfebe Senior Secondary School confirmed this and highlighted that marginalised schools have issues such as no electricity and lack of infrastructure. These are first-order barriers that hinder ICT integration. In addition to lack of resources such as infrastructure, lack of ICT budget and subject content were mentioned by the participants. The lack of ICT budget for tablet repairs served as a major concern amongst the teachers. They mentioned that the school would be forced to transfer all ICT costs to the parents. By this the participant meant that the school might have to charge an extra fee for tablet use. This fee is meant for breakages and any repairs. This would serve as a challenge considering the context and that most parents might not be able to afford the fee. Most people in rural areas depend on social grants, agricultural productivity and remittance from families as the main source of income (National Treasury, 2011; The World Bank, 2014). Lack of subject content on the server was highlighted meaning that not all teachers had the means to search

for their own content and create lessons. Participant A mentioned that she used her own data to search for information and additional tools that she could find to improve her lessons. However, not all teachers are able to do this due to the added expense.

- Another challenge experienced in marginalised schools is the conditions within which the students learn. The learning conditions are often not conducive or encouraging (see Chapter 5, section 5.9). Some schools have classrooms that are dusty, overcrowded and with little furniture. Furthermore, due to the landscape of the Eastern Cape, some schools are in isolated areas and as a result there are few teachers at the school, for example School D discussed in Chapter 5, section 5.9, had a total of three teachers, including the headmaster. Teachers at this school were responsible for three different grades each. These are issues that hinder ICT integration, even though the introduction of tablets at the school has encouraged teachers to move away from traditional pedagogical methods. The use of ICTs bring more work and duties for the teachers. Teachers in school D are most likely to revert back to traditional methods due to the extra work that is required.

- As discussed in Chapter 6, section 6.5.2.3, computer literacy served as a challenge. Even though this challenge might not be context specific it relates to most teachers. Data collection showed that training offered is for all teachers despite subject expertise or level of ICT use. The training focuses on equipping the teachers with teaching strategies and technology skills (ICT4RED, 2013). However, it is important to note that the majority of the teachers who go for training are teachers who have never used ICTs before. It is for this reason that it is important to provide computer literacy training most especially for veteran teachers. The case study showed that the introduction of ICTs encouraged teachers to move away from traditional pedagogical beliefs, however some teachers lagged behind in their use of ICTs (see Chapter 6, section 6.5.5.3). The participant attributed this to lack of passion and personal drive. However, lagging behind regarding ICT use in the classroom can also be attributed to the lack of computer efficacy. As mentioned in Chapter 6, section 6.5.5.1, teachers with high computer-efficacy tend to use computers more often and experience less computer anxiety, whereas teachers with low computer-efficacy tend to

experience frustration and hesitate to use computers (Sang, et al., 2010). It is important that the teachers' computer efficacy is built and that they are provided with basic skills before they focus on teaching strategies. As highlighted by TPACK framework, teachers need the Technological Knowledge (see Chapter 6, section 6.6).

- Another challenge that was specific to the case study, experienced by teachers at Arthur Mfebe was the lack of post training and support. The teachers expressed the need for continuous training. Participant A expressed that some teachers were assisted by their colleagues during the training and thus they failed to implement the strategies in their own classrooms because they did not know how to use the tablet independently (see Chapter 6, section 6.5.2.2). This highlighted the importance of continued support; if teachers lack this support they will revert to traditional methods.

- Lack of school leadership also emerged. Literature has emphasised the importance of supportive leadership that steers the project. The headmaster plays an important role in ensuring the acceptance of ICTs. They are responsible for steering the team and creating an environment where ICTs can be used (Flanagan and Jacobsen, 2003; Hew and Brush, 2007; Eteokleous, 2008). As discussed in Chapter 6, section 6.5.3.2 leadership is essential; the headmaster will be the one who influences the staff to implement and use ICTs in the classroom.

- Another context-specific challenge was the lack of student training. The participants mentioned that even though learners are exposed to cell phones, not all of them have been exposed to using touch screen cell phones or smart phones, hence there is a need to train the students on ICT use. The training needs to equip them with computer skills and skills on how to use the tablets alongside their textbooks. Unfortunately, teachers are overloaded and overworked and they do not have time to train the learners (see Chapter 6, section 6.5.3.1).

- The introduction of ICTs encourages movement away from the teacher being the main source of information (see Chapter 6, section 6.5.4.2). It is for this reason that the participants highlighted the importance of sitting in groups or

structures that encourage communication and discussion. However, this serves as a challenge when schools do not have the resources and support from leadership to enforce such changes.

The challenges mentioned above, in addition to others, are presented in the conceptual framework in Chapter 6, section 6.6. The framework captures key components that are essential when integrating ICTs into rural areas. This study contributes to the body of knowledge by presenting this framework which can be used as a point of departure for implementing ICT projects in rural areas in South Africa. The conceptual framework and the recommendations can be used by CSIR in planning the next TECH4RED project in any rural area.

Aspects relating to integration such as first-order barriers (see Chapter 3, section 3.3) and second-order barriers (see Chapter 3, section 3.4), as discussed in literature, are confirmed in this thesis. First-order barriers such as: lack of resources as one of the major barriers to integration. According to Khan, et al. (2012) the implementation of ICTs demands infrastructure such as reliable electricity supply, as well as resources such as computers, printers, scanners, and projectors etc., which are generally not available in rural areas. As discussed in Chapter 3 electricity served as a challenge at some schools. Furthermore, the lack of technical support is another barrier that was highlighted in literature. According to Ertmer, et al. (2012), there are different types of support needed to ensure effective integration. These include administrative, technological, professional and peer support. The participants mentioned that preparing lessons can be daunting and overwhelming and as a result some teachers revert to traditional methods (see Chapter 6, section 6.5.3). It is for this reason that the participants stated that there is a need for a technician at the school. Khan, et al., (2012) identified lack of time as another major first-order barrier; teachers are burdened with work as they are also responsible for administrative tasks. Most teachers complained about the time required to prepare for using ICTs, and the introduction of ICTs adds to their workload. ICT integration requires teachers to search for information, review websites and design content, as well as set up classroom activities that require ICT integration, rather than using the traditional textbook (Hew and Brush, 2007; Ertmer, et al., 2012).

Second-order barriers discussed in literature included teacher computer efficacy. According to Sang, et al. (2010), teacher computer efficacy refers to the teacher's own beliefs and perceptions of their capability to use computers. This was identified as a second-order barrier that hinders integration. Furthermore, it also emerged as a theme in the interviews (see Chapter

6, section 6.5.5). Participants mentioned that their ability to use ICTs affected their decision to integrate ICTs. Training plays an important role in increasing teacher computer-efficacy because it provides the teachers with the knowledge and skills to use ICTs (Ertmer, 2005; Eteokleous, 2008). Literature stated that teachers with higher computer-efficacy tend to use computers more often and they experience less computer-related anxiety, whereas teachers with lower computer-efficacy tend to experience frustration and hesitate to use computers when they encounter problems (Sang, et al., 2010). Computer efficacy is built over time and through constant computer use and support. In addition to computer efficacy, teacher attitude also emerged as an overarching theme. Literature refers to teacher attitude as a second-order barrier that is intrinsic to the teacher. It is rooted in the teachers' beliefs about teaching and learning. (Ertmer, 2005; Eteokleous, 2008; Sang, et al., 2010; Donelly, et al., 2011; Du Plessis and Webb, 2012). Teacher attitude is significantly linked to teacher pedagogical beliefs. According to Hermans, et al. (2008) and Liu (2011), each teacher enters the teaching setting with their personal theories about teaching and learning; they have their personal interpretation of the instructional situation and a set of beliefs that determine how students learn. This was revealed in the interviews (see Chapter 6, section 6.5.5.1). According to the participants, moving away from the traditional paradigm was challenging. Most teachers at the school were used to the textbook and chalk board and the introduction of the tablets required them to shift their paradigm.

This study also confirmed that the training provided in the ICT4RED project equips teachers with ICT strategies and skills to use in the classroom. Nonetheless, continued training and assistance is still needed and is essential in ensuring that teachers do not revert to traditional practices (see Chapter 6, section 6.5.5.2). Most participants felt that the training time was limited and they needed more time in order to be fully comfortable and confident with some of the strategies they were taught. Participant F mentioned this in the interview; when asked what he would change about the ICT4RED project, he explained that he would not change anything with the training. He would rather increase monitoring and ensure assistance for the teachers, mainly because people cannot be given a workshop and left alone. The participant continued to express that there was a need for continued training because teachers forget. Fullan (1992 cited in Khan, et al., 2012) also supported this: training should not be once off but should be an ongoing experience, so that teachers can be kept up to date with changing technology while gaining more confidence in their ability to use different ICTs. This will eventually result in teachers with high computer efficacy.

This study also covered the importance of passion and personal drive. According to Khan, et al. (2012), schools and training can encourage ICT use. However, actual use in the classroom is dependent on the teachers' attitudes, skills, and personal feelings. Data showed evidence of this, as one participant mentioned that even though they received training, some teachers are lagging behind (see Chapter 6, section 6.5.5.3). Ertmer et al. (2012) suggested that the best way to encourage teachers to integrate ICTs is through increasing the knowledge and skills of the teachers, which in turn can change their attitudes. However, in addition to skills and knowledge, data collection highlighted personal drive/passion. In Chapter 6, section 6.5.5.3, participant D mentioned that some teachers are lagging behind regarding ICT use in the classroom mainly because they did not have passion and they did not use ICTs outside the classroom. Thus, passion and personal drive emerged as an important theme in integration. Passion and personal drive are dependent on each individual and cannot be fully influenced by training as they are related to an individual's personal feelings. Data illustrated that some of the teachers who integrated ICTs in their classrooms had personal reasons that drive them to use ICTs, and they also actively used ICTs in their lives, thus highlighting that personal reasons, personal drive and personal feelings also had an impact on the level of integration and ICT use by teachers.

Another contribution of the research is the finding that pedagogical beliefs are influenced by the teachers' exposure to ICTs. Literature highlights that teachers with student-centred pedagogical beliefs are more likely to integrate ICTs than those with teacher-centred beliefs. However, in the case of rural areas such as Cofimvaba, teachers were not exposed to ICTs. As a result, they stuck to traditional practices. However, as indicated by one participant, training influenced their teaching practice, moving it from teacher-centred to a mix of student-centred and teacher-centred learning.

One of the biggest contributions is related to ensuring that there is assistance within the classroom. In order to ensure sustainability of the project and continued ICT integration, the participants mentioned that assistance within the classroom to set up and to also help with planning lessons is essential. Teachers mentioned that setting up projectors is time consuming and daunting. Thus, continued support emerged as an essential component in ensuring integration.

Furthermore, it is essential to understand that ICT integration will take time, especially because teachers and students are accustomed to teacher-centred practices. South African classrooms

are dominated by teachers who transfer knowledge instead of allowing students to construct knowledge. One needs to understand that the transition from teachers being at the centre of the classroom to being facilitators will take time, mainly because teachers are used to being the dominant force in the classroom and integration requires them to let go of the "textbook". It requires them to facilitate a learning process where the students take charge of their learning (Jansen, 2001). This require teachers to withdraw from traditional teaching and their comforts, which will take time; hence schools need to allocate more time towards ICT integration in teaching and learning in schools as it is a new concept (Ramorola, 2013).

7.5 Recommendations

The following recommendations are for the ICT4RED project particularly at Arthur Mfebe Senior Secondary School. These recommendations are based on findings from data collected through observations and the semi-structured interviews. The framework in Section 6.6 could be used to support these recommendations.

Firstly, there is a need for **more content on the server**. Based on findings described in Chapter 6, section 6.5.1.3 'Lack of Resources Thematic Map', it is essential that more content is made available for subjects such as Xhosa and English. According to the participants, lack of content for some subjects leads to limited use. This is evident as some teachers mention that teaching has changed for Mathematics and Science but not for other subjects. When implementing the next project, it is important to ensure that all subjects have sufficient content.

Secondly, **encourage schools to have an ICT budget**. Data obtained from observations revealed that the school lacks resources such as printers, routers and cables to connect to the projector and plugs in some classrooms; an ICT budget is important as it will assist in dealing with first-order barriers. Furthermore, in order to ensure sustainability and growth, the school needs an ICT budget for repairs and buying hardware (Ramorola, 2013). From observations and interviews, it became evident that participants were unhappy about the lack of transparency about finances within the school and the fact that they were told that no budget would be made available to them, even though the headmaster knew what ICT resources were needed. The participants mentioned that the school might have to charge extra fees to use tablets. This fee would be used to cover any damages to tablets. Considering the context and the fact that most people in rural areas are unemployed, extra costs will affect the sustainability of the project. Asking parents to pay for the ICTs will limit the use of tablets to those who are able to afford them and isolate those who cannot afford them.

Thirdly, ensure that there is **continuous teacher training**. As discussed in Chapter 6, 'Teacher Training Thematic Map' (Figure 6.5.2), teacher training time is limited and as a result teachers forget some strategies they have learnt about. It is for such reasons that participants highlighted the importance of continuous training. Participants mentioned that they need more time with training especially as, at their age, they found it difficult even to use their phones. One participant noted:

"I hope that the training can be an ongoing thing ... sometimes as rural teachers we forget we tend to go back to previous way of teaching."

It is for this reason that refresher courses or continuous training should be offered for the teachers.

Basic computer literacy for veteran teachers also emerged as an important theme. Participants highlighted the importance of providing teachers with basic computer skills in order to build their confidence when using any kind of ICT. This was linked to teacher computer efficacy, which refers to the teachers' belief and perceptions of their capability to use computers (Sang, et al., 2010). Teachers with higher computer efficacy tended to use computers more often and they experienced less computer-related anxiety. Veteran teachers should have training that focuses on basic computing, where they learn how to use the computer as well as how to use the internet. This would also assist in content creation, as teachers need to search for their own content. Basic computer skills would increase teacher confidence and would result in teachers learning how to use other ICTs. The teachers' willingness to experiment and explore different ways to use the tablet would also increase.

Student training was also highlighted as important. Teachers are overworked and very busy. They do not have time to train the learners on how to use the tablets. Even though learners are exposed to cell phones, not all of them have been exposed to using touch screen cell phones or smart phones, hence there needs to be tablet training for learners. The training needs to equip them with computer skills and skills on how to use the tablets alongside their textbooks. In addition to student training, assistance at the school should be provided.

Besides technical support, there is a need for an **ICT or IT specialist** at the school dedicated to assisting teachers with lesson preparation and using equipment within the classroom. Participants mentioned that sometimes they forget how to apply strategies and because their fellow colleagues are busy they have no one to consult. Even when the technical consultant

was present, the participants mentioned that they would have preferred to have someone to help with lesson planning as well as setting up equipment within the classroom. These assistants could also assist those teachers who are still not comfortable with integrating ICTs. They would work alongside the teachers to formulate an integration strategy and ensure that all teachers in the school used their tablets.

Changes in the school environment is another important aspect in ensuring ICT integration. Participant A highlighted the impact of the classroom setting in ensuring integration. The participant mentioned that, in order to ensure transformation within the classroom and change in the education, it is essential that the classroom setting is appropriate. During the observations of a Mathematics lesson and an Agriculture lesson (Chapter 5, Section 5.9) where ICTs were integrated, the teacher had to choose a certain number of learners and rearrange the classroom. The lesson could not be conducted with the whole class due to the numbers of learners. Overcrowded classes can limit integration. Furthermore, the observation highlighted the importance of having a classroom setting that encourages group work and allows tablets to be used easily in the classroom. The traditional seating of learners facing the teacher in front limits their ability to use the tablets in groups and prohibits communication amongst the learners.

Leadership within the school and from the Department of Education also emerged as an important factor. Firstly, it is essential that school leadership buys into the project. Based on the observations, schools where the headmaster was involved in the project showed more ownership and involvement. Headmasters are seen as managers and change agents who should work with the staff to create a vision for technology implementation and an environment that promotes integration (Flanagan and Jacobsen, 2003; Hew and Brush, 2007; Eteokleous, 2008). Thus they should act as a catalyst for change in the school and lead the integration of ICTs. Furthermore, the headmaster should follow up and observe whether teachers are making use of the resources available. Support from the Department of Education within the district was equally important. In South Africa teachers in leadership positions tend to need ICT training as part of their repertoire. Young teachers with little teaching experience come with passion and ICT skills, but they are not in leadership positions. This has an impact on the level of support and enthusiasm towards ICT integration, most especially if the subject advisors do not have ICT training. For example, one can question the level of involvement that the subject advisors have at the schools once the project has been implemented. What support does the Department provide to ensure sustainability and continued use of the ICTs? DoE needs to visit the schools and evaluate what support they need to ensure integration.

7.6 Limitations

During this study, there were a number of limitations. This section will discuss those limitations and ways in which the researcher addressed these.

Six participants were interviewed. This served as a limitation mainly because more interviews would have provided the researcher with more perspectives. The reasons for the limited number of interviews included:

- Arthur Mfebe Senior Secondary School was the only school that had teachers who had completed the ICT training and had been using the tablets for two years at the time of the study. The researcher chose Arthur Mfebe because of this.

- At the school all thirteen teachers went for training; however, the researcher was only able to interview six participants. The rest of the teachers indicated that they were too busy. During the interviews it became evident that some of the teachers who volunteered themselves for interviews were the ones who were actively involved in the ICT4RED project. This served as an advantage as these teachers provided more in-depth information and they also provided information on why other teachers do not integrate ICTs. It served as a limitation though in that the perspectives of those disinterested in ICTs were not included.

Even though the number of interviewees served as a limitation, the researcher conducted in-depth interviews which revealed considerable information. Furthermore, the researcher also observed training and lessons at the school to support findings from the interviews.

It was evident to the researcher that her presence in the classroom affected how the students would generally behave and it also affected how the teacher conducted the lesson. This served as a limitation. However, the observations provided insight on how teachers generally use the tablets in the school.

Another limitation was that, as the pilot school, Arthur Mfebe Senior Secondary School was 'over researched'. This led to teachers being exhausted and the school being frequently disrupted by researchers such as me. Further research is therefore necessary to study other schools in the area and to test other theoretical themes such as third-order barriers (see Chapter 3, Section 3.2). A follow-up study to test the framework (Section 6.6) on schools in Phase 2 (Siyabalala Senior Secondary School, Kwahza Senior Secondary, Mtimbini and Bangilize)

would be useful in overcoming this limitation. The testing of the framework would determine whether they have experienced the same challenges as Arthur Mfebe Senior Secondary School.

Appendix A: Field Procedures

Lubbe (1998: 66) cited in Krauss (2007) provide field procedures to ensure that the researcher conducts informative interviews. The author suggests the following procedures:

i. Using a gatekeeper as reference: Contact two willing and able participants within the community.

ii. Making initial contact with the participants in order to get consent for conducting the interviews and using responses for research purposes.

iii. Schedule a convenient interview time in a relaxed and quiet setting. Ensure that enough time is available.

iv. Commence each interview with a brief introduction of the intentions of the research. The researcher will be required to also explain the type of questions that will be presented and why the interviewee is selected.

v. Inform the interviewee that the interview will be recorded. The researcher also needs to ensure that the interviewee understands that they are at liberty to withdraw from the project at any time, should they so desire. Their responses will be treated as private and confidential.

vi. Ensure that the interviewee does not have a problem with being recorded.

vii. Ensure that interviewees do not discuss interview content with other possible participants so as to avoid bias as far as possible.

viii. During the interview ensure as far as possible that the interviewee is at ease at all times.

ix. During the interview take care that the researcher's body language and other possible cues do not influence the interviewee's thinking or responses.

x. In an effort to minimise subjective bias the same general open-ended questions should be presented to all interviewees in the similar order.

Appendix B: Interview Guide

Leedy and Ormrod (2010) provide guidelines for conducting interviews in qualitative research; the following suggestions were made by these authors:

i. The researcher must identify some questions in advance: conducting semi-structured or unstructured interviews requires skill and experience and the researcher must be able to sense when the interview is drifting and steer it back on course.

ii. The researcher needs to consider the participants' cultural background, as this might influence their responses, especially because interpretivism encourages the participants to express their opinions.

iii. The researcher needs to ensure that interviewees are representatives of the group.

iv. The researcher needs to find a suitable location in order to conduct the interview. It is essential to find a quiet place where the interviewee is unlikely to get distracted.

v. Written permission is required from the participants. The participants therefore need to sign a consent form.

vi. Establish and maintain rapport. Leedy and Ormrod (2010) mentioned that the researcher should begin the interview with small talk that will break the ice. The researcher should also remember to remain respectful and courteous at all times.

vii. Researchers need to ensure that they do not put words into the participants' mouths.

viii. Capture and record responses precisely.

ix. Focus on the actual rather than on the abstract or hypothetical

x. It is essential that the researcher maintains a neutral face and does not show disapproval or surprise to responses given.

xi. The researcher has to remember that all participants' responses are not facts but merely perceptions.

References

Achimugu, P., Oluwagbemi, O., Oluwaranti, A. and Afolabi, B., 2009. Adoption of information and communication technologies in developing countries: An impact assessment. *Journal of Information Technology Impact*, 9(1), pp.37-46.

Albion, P. R., 1999. Self-efficacy beliefs as an indicator of teachers' preparedness for teaching with technology. Available at: https://eprints.usq.edu.au/6973/1/Albion_SITE_1999_AV.pdf. [Accessed March 2013].

Andrade, D. A., 2009. Interpretive research aiming at theory building: Adopting and adapting the case study design. *The Qualitative Report*, 14(1), pp.42-60.

Ashraf, M., Hanisch, J. and Swatman, P., 2008. Towards a conceptual framework for understanding Information and Communication Technologies for Development (ICT4D) projects in developing countries. Paper presented at: IADIS International Conference ICT, Society and Human Beings.

Baeten, M., Kyndt,E., Struyven, K. and Dochy, F., 2010. Using student-centred learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. Available at: https://lirias.kuleuven.be/bitstream/123456789/270559/2/Review.pdf. [Accessed March 2013].

Balanskat, A., Blamire, E. and Kefala, S., 2006. The ICT Impact Report: A review of studies of ICT impact on schools in Europe. Available at: http://colcct.colfinder.org/sites/default/files/ict_impact_report_0.pdf. [Accessed January 2014].

Ballantyne, J., 2003. Current trends in teacher education: Some implications. Proceedings of: New Zealand Association of Research in Education /Australian Association of Research in Education Joint Conference 2003, Auckland, New Zealand, pp. 11-19.

Bialobrzeska, M. and Cohen, S., 2005. Managing ICTs in South African schools: A guide for school principals. Braamfontein: South African Institute for Distance Education (SAIDE). [Online]. Available at: http://www.education.gov.za/Portals/0/Documents/Reports/Managing%20ICTs%20in%20South%20African%20Schools.pdf?ver=2011-01-18-115657-700. [Accessed March 2014].

Botha, A. and Herselman, M., 2013. Supporting rural teachers' 21st century skills development through mobile technology use: A case in Cofimvaba, Eastern Cape, South Africa. [Online]. Available at: http://0-ieeexplore.ieee.org.wam.seals.ac.za/xpl/login.jsp?tp=&arnumber=6707490&url=http%3A%2F%2F0ieeexplore.ieee.org.wam.seals.ac.za%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6707490. [Accessed: June 2014].

Botha, A., Herselman, M. and Ford, M., 2014. ICT4RED 12-Component Implementation Framework: A conceptual framework for integrating mobile technology into resource-constrained rural schools. [Online]. Available at: https://www.researchgate.net/publication/263922686_ICT4RED_12-Component_Implementation_Framework_A_conceptual_framework_for_integrating_mobile_technology_into_resource-constrained_rural_schools. [Accessed September 2013].

Boynton, P, M., 2005. The research companion. A practical guide for the Social and Health sciences. New York: Psychology Press.

Braun, V. and Clarke,V., 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), pp. 77-101.

Brekhus, W. H., Galliher, J. F. and Gubrium, J. F., 2005. The need for thin description. *Qualitative Inquiry*, 16(6), pp. 1-19.

British Educational Communications and Technology Agency (Becta), 2003. Primary Schools-ICT and standards. Available at: http://colccti.colfinder.org/sites/default/files/ict_impact_report_0.pdf. [Accessed March 2014].

Burney, S. M., 2008. Inductive and deductive research approach. Available at: http://www.drburney.net/INDUCTIVE%20&%20DEDUCTIVE%20RESEARCH%20APPROACH%2006032008.pdf. [Accessed: September 2013].

Chai, C. S., Hong, H. Y. and Teo, T., 2009. Singaporean and Taiwanese pre-service teachers' beliefs and their attitude towards ICT use: A comparative study. *The Asia-Pacific Education Researcher*, 18(1), pp.117-128.

Chen, C. H., 2008. Why do teachers not practice what they believe regarding technology integration? *Journal of Educational Research,* 102(1), pp.65-75.

Chunghtai, H. and Myers, M., 2014. Ethnographic field research: Interpreting one's entrance into the field as thrownness. [Online]. Available at: http://aisel.aisnet.org/ecis2014/proceedings/track19/4/. [Accessed: March 2014].

Cooke, A. and Dawson, V., 2012. A case study of the role of ICT in a Grade 6 classroom. *International Journal of e-Learning Security,* 2(2), pp.138-145.

Creswell, J. W., Hanson, E. W., Plano, V. L.C. and Morales, A., 2007. Qualitative research designs, selection and implementation. *Counseling Psychologist*, 35(2), pp. 236-264.

Davies, B. M., 2007. *Doing a successful research project: Using qualitative or quantitative methods*. New York: Palgrave MacMillan.

Davies, D. and Dodd, J., 2002. Qualitative research and the question of rigor. *Qualitative Health Research*, 12(2), pp. 279-289.

Davies, G. and Dwyer, C., 2007. Qualitative methods: Are you enchanted or are you alienated. *Progress in Human Geography*, 31(2), pp. 257-266.

Davis, N., Preston, C. and Sahin, I., 2009. Training teachers to use new technologies impacts multiple ecologies: Evidence from a national initiative. *British Journal of Education Technology*, 40(1), pp. 861-878.

Demetriadis, S., Barbas, A., Molohides, A., Palaigeorgiou, G., Psillos, D., Vlahava, I., Tsoukalas, I. and Pombortsis, A., 2003. 'Cultures in negotiation': Teachers' acceptance/resistance attitudes considering the infusion of technology into schools, *Computers & Education*, 41(1), pp.19-37.

Department of Education (DoE). 2006. White Paper on e-Education. Transforming Learning and Teaching through Information and Communication Technologies. South Africa: Department of Education. [Online]. Available at: http://www.education.gov.za/Portals/0/Documents/Legislation/Call%20for%20Comments/DRAFT%20E-EDUCATION%20WHITE%20PAPER.pdf?ver=2008-03-05-104602-000. [Accessed: March 2014].

Donnelly, D., McGarr, O. and O'Reilly, J., 2011. A framework for teachers' integration of ICT into their classroom practice. *Computers & Education*, 57(2011), pp. 1469-1483.

Du Plessis, A. and Webb, P., 2008. Generative use of computers: promoting critical outcomes of the South African curriculum. *Education as change*, 12(1), pp. 15-27.

Du Plessis, A. and Webb, P., 2012. Teachers' perception about their own and their schools' readiness for computer implementation: A South African case study. The Turkish Online *Journal of Educational Technology*, 11 (4), pp. 312-325.

Ertmer, A. P., 2005. Teacher pedagogical beliefs: The final frontier in our quest for technology integration?. *Educational Technology Research and Development*, 53(4), pp.25-39.

Ertmer, A. P., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E. and Sedurur, P., 2012. Teacher beliefs and technology integration practices: A critical relationship. *Computers and Education*, 59(2), pp. 423-435.

Ertmer, P., 1999. Addressing first- and second-order barriers to change: Strategies for technology implementation. *Educational Technology Research and Development*, 47(4), pp. 47-61.

Ertmer, P., 2000. Responsive instructional design: Scaffolding the adoption and change process. Available at: http://files.eric.ed.gov/fulltext/ED455769.pdf. [Accessed: October 2013].

Eteokleous, N., 2008. Evaluating computer technology integration in a centralized school system. *Computers & Education*, 51(2), pp. 669-686.

Evoh, J. C., 2007. Collaborative partnerships and the transformation of secondary education through ICTs in South Africa. *Educational Media International*, 44 (2), pp. 81-89.

Fereday, J. and Muir-Cochrane, E. 2006. Demonstrating rigor using thematic analysis: a hybrid approach of inductive and deductive coding and theme development. Available at: https://www.ualberta.ca/~iiqm/backissues/5_1/PDF/FEREDAY.PDF. [Accessed: October 2013].

Flanagan, L. and Jacobsen, M., 2003. Technology leadership for the twenty-first century principal. *Journal of Education Administration*, 41(2), pp. 124-142.

Foddy, W. H., 2001. *Constructing questions for interviews and questionnaires: Theory and practice in social research*. New York: Cambridge University Press.

Fourie, I. and Krauss, K., 2011. Information literacy training for teachers in rural South Africa. *Journal of Systems and Information Technology*, 13(3), pp. 303-321.

Geertz, C., 1973. The interpretation of cultures. Available at: https://monoskop.org/images/5/54/Geertz_Clifford_The_Interpretation_of_Cultures_Selected_Essays.pdf. [Accessed: October 2013].

Goktas, Y., Gedik, N. and Baydas, O., 2013. Enablers and barriers to the use of ICT in primary schools in Turkey: A comparative study of 2005-2011. *Computers & Education*, 68, pp. 211-222.

Graham, R. C., 2011. Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education,* 57(3), pp. 1953-1960.

Hayes, K. B., Heit, E. and Swendsen, H., 2010. Inductive reasoning. Available at: http://faculty.ucmerced.edu/sites/default/files/eheit/files/wires.pdf. [Accessed: October 2013].

Hennessy, S., Harrison, D. and Wamakote, L., 2010. Teacher factors influencing classroom use of ICT in Sub-Saharan Africa. *Itupale Online Journal of African Studies*, 2(1), pp.39-54.

Hermans, E., Tondeur, J., van Braak, J. and Valcke, M., 2008. The impact of primary school teachers' educational beliefs on the classroom use of computers. *Computers & Education*, 51(4), pp. 499-1509.

Hew, K. F. and Brush, T., 2007. Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Springer*, 55(3), pp. 223-252.

Hodgkinson-Williams, C., 2006. Revisiting the concept of ICTs as 'tools': Exploring the epistemological and ontological underpinnings of a conceptual framework. Available at: http://itforum.coe.uga.edu/paper88/Hodgkinson-Williams-2006rev.pdf. [Accessed: November 2013].

Hokanson, B. and Hooper, S., 2000. Computers as cognitive media: Examining the potential of computers in education. *Computers and Human Behavior*, 16(5), pp. 537-552.

Huang, H. M. and Liaw, S. S., 2005. Exploring users' attitudes and intentions toward the web as a survey tool. *Computers in Human Behavior,* 21(4), pp. 729-743.

ICT4RED., 2013. The ICT4RED Cofimvaba story. [Online]. Available at: http://www.ict4red.co.za/prepare-your-school-for-tablets/the-ict4red-cofimvaba-story. [Accessed: April 2014]

Jansen, J. D., 2001. Image-ining teachers: Policy images and teacher identity in South African classrooms. *South African Journal of Education*, 21(4), pp. 242-246.

Kaplan, B. and Maxwell, J. A., 2005. Qualitative research methods for evaluating computer information systems. Available at: http://content.schweitzer-online.de/static/content/catalog/newbooks/978/038/724/9780387245584/9780387245584_Excerpt_001.pdf. [Accessed: November 2013].

Khan, H. S., Hasan, M. and Clement, K. C., 2012. Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. *International Journal of Instruction*, 5(2), pp. 1-80.

Khine, M. S., 2001. Attitudes toward computers among teacher education students in Brunei Darussalam. *International Journal of Instructional Media*, 28(2), pp. 147-153.

Kirschner, P. and Selinger, M., 2003. The state of affairs of teacher education with respect to information and communications technology. *Technology, Pedagogy and Education*, 12(1), pp. 5-17.

Klein, K. and Myers, D. M., 1999. A set of principles for conducting and evaluating interpretive field studies in information systems. *Management Information Systems Quarterly*, 23(1), pp. 67-93.

Koehler, M. and Mishra, P., 2009. What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education,* 9(1), pp. 30-70.

Koehler, M. J., Shin, T. S. and Mishra, P., 2012. How do we measure TPACK? Let me count the ways. Available at: http://punya.educ.msu.edu/wp-content/uploads/2011/09/Koehler_Shin_Mishra_2011.pdf. [Accessed: July 2013]

Krauss, K., 2007. *Visual aesthetics and its impact on online communication intent*. Master of Commerce. University of KwaZulu-Natal.

Lee, A. S., 1991. Integrating positivist and interpretive approaches to organizational research, *Organization Science*, 2, pp. 342-365.

Leedy, D. P. and Ormrod, E. J., 2010. Practical research: Planning and design. New York: Pearson.

Li, Q., 2007. Student and teacher views about technology: A tale of two cities? *Journal of Research on Technology in Education*, 39(4), pp. 377-397.

Lim, P. C. and Chai, S. C., 2008. Teachers' pedagogical beliefs and their planning conduct of computer-mediated classroom lessons. *British Journal of Educational Technology*, 39(5), pp. 807-828.

Liu, S. H., 2011. Factors related to pedagogical beliefs of teachers and technology integration. *Computers & Education,* 56(4), pp. 1012-1022.

Loveless, A., De Vooged, G. L. and Bohlin, R. M., 2001. Something old, something new: Is pedagogy affected by ICT? [Online]. Available at: http://books.google.co.za/books?hl=en&lr=&id=C2i_bAzneVIC&oi=fnd&pg=PA63&dq=Loveless,+DeVoogd+and+Bohlin,+2001&ots=bqhWHUUR3A&sig=oG0VzZ9wAsHNnoMz0UI10jYuSRQ#v=onepage&q&f=false. [Accessed: January 2014].

Madumere-Obike, C. B. and Imgbi, A. J., 2012. Integrating information and communication technology (ICT) into teaching and learning in Baysela state secondary schools. *Journal of Education in Developing Areas*, 20, pp. 639-647.

Maholwana-Sotashe, N., 2007. *Challenges faced by secondary school teachers in integrating ICT into curriculum: A multiple case study in the Grahamstown circuit.* Master of Education and Information Communication Technology in Education. Rhodes University.

Martinovic, D. and Zhang, Z., 2012. Situating ICT in the teacher education program: Overcoming challenges, fulfilling expectations. *Teaching and Teacher Education*, 28(3), pp. 461-469.

Merriam, S. B., 2002. Introduction to qualitative research. Available at: http://stu.westga.edu/~bthibau1/MEDT%208484%20Baylen/introduction_to_qualitative_research/introduction_to_qualitative_research.pdf. [Accessed: June 2013].

Mueller, J., Wood, E., Willoughby, T., Ross, C. and Specht, J., 2008. Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers & Education*, 51(4), pp. 1523-1537.

Mulhall, A., 2003. In the field: Notes on observation in qualitative research. *Journal of Advanced Nursing*, 41(3), pp. 306-313.

Myers, D. M. and Newman, M., 2007. The qualitative interview in IS research: Examining the craft. *Information and Organization,* 17, pp. 2-26.

Myers, D. M., 1997. Qualitative research in information systems. [Online] Available at: http://www.qual.auckland.ac.nz/. [Accessed: June 2013].

Myers, D. M., 2009. *Qualitative research in business management*. Thousand Oaks, CA: Sage.

Naicker, V., 2010. Educator's pedagogy influencing the effective use of computers for teaching purposes in classrooms: Lessons learned from secondary schools in South Africa. *Educational Research and Review*, 5(11), pp. 679-689.

Nandhakumar, J. and Jones, M., 1997. Too close for comfort? Distance and engagement in interpretive information systems research. *Information Systems Journal*, 7(2), pp. 109-131.

National Treasury, 2011. Delivering municipal services in rural areas. Available at: http://www.treasury.gov.za/publications/igfr/2011/lg/15.%20Rural%20services%202011%20LGBER%20-%20Final%20-%209%20Sept%202011.pdf. [Accessed: November 2014].

NetTel, 2005. Macro environment and telecommunications. [Online]. Available at: http://cbdd.wsu.edu/kewlcontent/cdoutput/TR501/page59.html. [Accessed: March 2013].

News24, 2014. New paper-less education system launches. [Online]. Available at: http://www.news24.com/SouthAfrica/News/New-paperless-education-system-launches-20150114. [Accessed: December 2014].

Ngwenyama, O., Andoh-Baidoo, K. F., Bollou, F. and Morawczynski, O., 2006. Is there a relationship between ICT, health, education and development? An empirical study analysis of five Western African Countries from 1997-2003. *EJISDC*, 23(5), pp. 1-11.

Nwagwu, E. W., 2006. Integrating ICTs into the globalization of the poor developing countries. *SAGE Publications*, 22(3), pp. 169-179.

Oates, B. J., 2006. *Researching information systems and computing*. Thousand Oaks. CA: Sage.

Odera, F. Y., 2011. Computer education policy and its implementation in Kenyan secondary schools. *International Journal of Information and Communication Technology Research,* 1(5), pp. 221-229.

Pade, C., Mallison, B. and Sewry, D., 2008. An elaboration of critical success factors for rural ICT project sustainability in developing countries: Exploring the DWESA case. *Journal of Information Technology Case and Application Research*, 10(4), pp. 32-55.

Pelgrum, W. J., 2001. Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education,* 37(2), pp. 163-178.

Polly, D. and Brantley Dias, L., 2009. TPACK: Where do we go now? *TechTrends*, 53(5), pp. 46-47.

Ramorola, M. Z., 2013. Challenge of effective integration into teaching and learning. *African Education Review*, 10(4), pp. 654-670.

Rubin, A. and Babbie, E. R., 2001. Research methods for social work. Belmont, CA: Wadsworth/Thomson Learning.

Sandholtz, J. and Reilly, B., 2004. Teachers, not technicians: Rethinking technical expectations for teachers. [Online]. Available at: http://0-www.tcrecord.org.wam.seals.ac.za/Content.asp?ContentId=11525. [Accessed: June 2014].

Sang, G., Valcke, M., van Braak, J. and Tondeur, J., 2010. Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviour with educational technology. *Computers & Education*, 54(1), pp. 103-112.

Schultze, U. and Avital, M., 2011. Designing interviews to generate rich data for information systems research. *Information and Organization,* 21(1), pp. 1-16.

Schultze, U., 2000. A confessional account of an ethnography about knowledge work. *MIS Quarterly*, 24(1), pp. 3-41.

Smaldino, S. E., Lowther, D. L., and Russell, D.J., 2008. *Instructional technology and media for learning* (9th ed.). Upper Saddle River, NJ: Prentice Hall.

Smeets, E., 2005. Does ICT contribute to powerful learning environments in primary education? *Computers & Education*, 44(1), pp. 343-355.

Song, L., Hannafin, J. M. and Hill, R. H., 2007. Reconciling beliefs and practices in teaching and learning. *Educational Technology Research and Development*, 55(1), pp. 27-50.

Tashakkori, A. and Teddlie, C., 2003. The past and future of mixed methods research from data triangulation to mixed model designs. *Handbook of mixed methods in social and behavioral research,* pp. 671-702. Thousand Oaks, CA: Sage.

Tedlock, B., 1991. The observation of participation and the emergence of public ethnography. *Journal of Anthropological Research,* 47, pp. 69-94.

Tedlock, B., 2007. The observation of participation and the emergence of public ethnography. Available at: http://www.corwin.com/sites/default/files/upm-binaries/21156_Chapter_5.pdf. [Accessed: June 2014].

Teo, T., 2009. Modelling technology acceptance in education: A study of pre-service teachers. *Computers & Education*, 52 (2), pp. 302-312.

Thurmond, A. V., 2001. The point of triangulation. *Journal of Nursing Scholarship*, 33(3), pp. 253-258.

Toledo, C., 2005. A five stage model of computer technology integration into teacher education curriculum. *Contemporary Issues in Technology and Teacher Education*, 5(2), pp. 77-191.

Tsai, C. and Chai, C. S., 2012. The 'third'-order barrier for technology integration instruction: Implications for teacher education [Online]. Available at: http://www.ascilite.org.au/ajet/ajet28/tsai-cc.html [Accessed: October 2013].

United Nations Educational, Scientific and Cultural Organization (UNESCO), 2002. Information and Communication Technology in Education. A Curriculum for Schools and Programme of Teacher Development. Available at: http://unesdoc.unesco.org/images/0012/001295/129538e.pdf. [Accessed: March 2013].

United Nations Educational, Scientific and Cultural Organization (UNESCO), 2008. ICT competency standards for teachers policy framework: Implementation guidelines, Version

1.0. Available at: http://unesdoc.unesco.org/images/0015/0015362/156209E.pdf. [Accessed: February 2013].

United Nations Educational, Scientific and Cultural Organization (UNESCO), 2012. ICT Competency Standards modules. Available at: http://unesdoc.unesco.org/images 0015/001562/156207e.pdf. [Accessed: February 2013].

United Nations Educational, Scientific and Cultural Organization (UNESCO) and Commonwealth of Learning, 2004. Schoolnet Toolkit.Bangkok. Available at: http://unesdoc.unesco.org/images/0013/001355/135564e.pdf. [Accessed: March 2013]

Unwin, T., 2005. Towards a framework for the use of ICT in teacher training in Africa. *Open Learning*, 20(2), pp. 113-129.

Vaismoardi, M., Turune, H. and Bondas, T., 2013. Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing and Health Sciences*, 15(1), pp. 398-405.

Vidich, J., 1955. Participation observation and the collection and interpretation of data. *American Journal of Sociology,* 60(4), pp. 354-360.

Vodacom, 2013. Tablets boost matric results in rural schools. [Online]. Available at: http://digitalclassroom.co.za/digitalclassroom/latestnews/news-2013/395-tablets-boost-matric-results-in-rural-schools. [Accessed: October 2014].

Walsham, G. and Sahay, S., 2006. Research on information systems in developing countries: Current landscape and future prospects. *Information Technology for Development*, 12(1), pp. 7-24.

Watson, S. L. and Watson, W. R., 2011. The role of technology and computer-based instruction in a disadvantaged alternative school's culture of learning, *Computers in the Schools*, 28(1), pp. 39-55.

Wilson-Strydom, M. and Thomson, J., 2005. Understanding ICT integration in South African classrooms. Available at: http://mthombo.org.za/download_ filefolder/Understanding%20ICT%20integration%20in%20South%20African%20Classrooms.pdf. [Accessed: March 2013].

World Bank, 2014. The World Bank Annual Report 2014. Available at: http://www.worldbank.org/en/about/annual-report. [Accessed: March 2014].